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STATUS OF SEASAT COMMERCIAL DEMONSTRATION PROGRAM

A Report of the Workshop Held at the Jet Propulsion Laboratory on 31 October and 1 November 1978

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STATUS OF SEASAT COMMERCIAL DEMONSTRATION PROGRAM

A Report of the Workshop Held at the
Jet Propulsion Laboratory on
31 October and 1 November 1978

December 1978

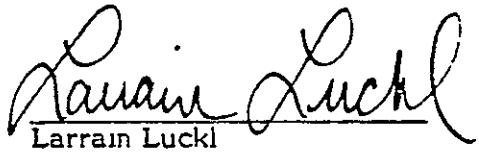
NOTE OF TRANSMITTAL

This report documents the results of a two-day workshop held at The Jet Propulsion Laboratory, Pasadena, California on 31 October and 1 November 1978. The objectives of this workshop were to review the status of the SEASAT-A program, particularly the Commercial Demonstration Program, in light of the failure of the SEASAT-A spacecraft on 10 October 1978 and to obtain inputs from the industrial experimeters that could be used to modify the planned program of experiments to be conducted on the industrial applications of SEASAT-A data.

The meeting was attended by representatives of 19 of the 22 experiments, NASA, JPL, Battelle and ECON, Inc.

In this two-day workshop, it was the consensus of the industry participants that many of the objectives of the SEASAT-A Commercial Demonstration Program could be fulfilled even though the SEASAT-A spacecraft had failed. The experimenters strongly urged that NASA continue a program to evaluate the economic and operational potential of the data gathered during the life of SEASAT-A, and to evaluate the real-time data distribution system established as a part of the SEASAT-A Project. The industry experimenters indicated their willingness to continue to participate in a program that would be aimed at completing this evaluation.

This report was prepared by Ms. Larrain Luckl and Mr. B. P. Miller of ECON, Inc. The statements of modified user requirements tabulated on pages 39 through 46 were prepared by Mr. Samih Mouneimne of JPL. Many of the figures and tables used in this report are copies of viewgraphs used in the workshop. These illustrations have not been redrawn and are included as they were presented at the workshop. The authors wish to express their thanks to the participants in this workshop for their assistance in providing copies of the material used in their presentation.



Larrain Luckl

B. P. Miller

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EARTH RESOURCES - NTIS

1. INTRODUCTION

SEASAT-A is an experimental ocean survey satellite which is designed to orbit the earth 14 times daily and cover 95 percent of the globe's ocean areas every 36 hours. The satellite is equipped with five sensors--three active microwave sensors, one passive microwave sensor and one visible and infrared radiometer. These sensors are designed to observe surface winds, temperature, currents, wave heights, ice conditions and ocean topography. The SEASAT-A Commercial Demonstration Program is intended to demonstrate the economic and operational impacts of near-real-time ocean observation data on maritime and off-shore industries. SEASAT-A was launched on June 26, 1978 and failed on October 10, 1978, before the start of the Commercial Demonstration Program. This early failure led to the need for the reevaluation of the plans for the Commercial Demonstration Program.

The data from all SEASAT-A sensors, except the Synthetic Aperture Radar (SAR) were to be converted into geophysical units and identified with geographic coordinates at the U.S. Navy Fleet Numerical Weather Center (FNWC), Monterey, California about 2 to 3 hours after receipt from the satellite. These data were then to be incorporated into standard analysis and forecast products by FNWC. SAR data was to be processed by the Jet Propulsion Laboratory (JPL).

Two types of experiments were planned for the Commercial Demonstration Program, namely real-time and nonreal-time experiments. The real-time experimenters were to receive the SEASAT-A data (processed to geophysical units) and the FNWC analysis and forecasts for many ocean parameters derived from the

combination of satellite and ocean surface observations via a specialized data network from FNWC.

Nonreal-time experimenters were to be provided with the aforementioned data sets and certain selected Synthetic Aperture Radar (SAR) data processed at the Jet Propulsion Laboratory. Approximately 15 to 20 percent of the acquired SAR data was to be processed and made available to the commercial experimenters. Nonreal-time data was to be mailed to the experimenters.

The SEASAT-A Commercial Demonstration Program is a cooperative effort with industries and government agencies in maritime and offshore operations who could benefit from improved measurements and forecasts of weather and ocean conditions. The objectives of the Commercial Demonstration Program are to develop a set of designed experiments in order to:

- Demonstrate techniques to monitor the Earth's oceanographic phenomena and features from space on a global scale
- Identify the characteristics of an operational satellite system of economic importance to industrial users
- Provide data to support estimates of the potential economic benefits of an operational system
- Provide oceanographic data in a timely fashion to scientists and commercial users who regard the oceans as a resource, i.e., ocean shippers, fishermen, marine geologists, etc.
- Begin the transfer of the utilization of ocean remote sensing technology to the commercial marine sector.

On 10 October 1978, after 106 days of highly successful operation, the SEASAT-A satellite experienced a major power failure. The reason for the failure is currently under investigation. At this time it appears highly unlikely that contact will be resumed with the satellite. A NASA Failure Investigation Board, headed by Dr. Bruce Lundin, former director of NASA's Lewis Research Center, is currently investigating the failure to determine the possible causes in order to

avoid them in future missions. Results from this board are not expected before the end of 1978.

Prior to the failure of SEASAT-A, the Commercial Demonstration Program experiments were scheduled to begin during December 1978 and to continue for a two-year period. As a result of the premature failure of SEASAT-A, it was necessary to reevaluate the plans for the Commercial Demonstration Program. Many of the experiments were planned around the receipt of near-real-time data from FNWC and, with the failure of SEASAT-A, the SEASAT-A content is removed from the FNWC data. However, two elements of the SEASAT-A program remain available for evaluation. These are the data set consisting of 99 days of data collected by SEASAT-A and the User Data Distribution System (UDDS) established to provide a computer-controlled network for near-real-time distribution of data from FNWC to the commercial users.

The purpose of this workshop was to convey the current status of the SEASAT-A satellite and Commercial Demonstration Program to the industry experimenters in order to evaluate the interest of the industry experimenters in the possibility of proceeding with a modified experiment program. The plan of the workshop was for JPL and NASA to describe the data and facilities available to the industry experimenters, and for the experimenters, in turn, to advise JPL and NASA on their interests and desires relative to the possibility of performing a modified experiment program.

2. SUMMARY AND CONCLUSIONS OF THE MEETING

On 31 October and 1 November 1978, 32 participants in the SEASAT-A Commercial Demonstration Program met at the Jet Propulsion Laboratory to be briefed on the status of the program. Representatives of 19 of the 22 planned experiments were present at this meeting along with personnel from JPL, NASA and program support contractors.

Mr. Montgomery from JPL opened the workshop, thanking the participants for responding on short notice to the call for the meeting. He stated that the meeting was necessitated by the untimely failure of SEASAT-A and the resulting need to reevaluate the planned experiment program. Mr. Giberson from JPL and Mr. Broome of NASA Headquarters welcomed the participants to JPL, reiterating the meeting's objectives.

A summary of the sensor performance during the period of satellite operation and character of the existing data set was explained in detail to the group. The current status and the immediate plans for the data processing were then discussed leading into presentations concerning the data distribution system's capabilities and status. The uncertainties and possible changes in the original SEASAT-A Commercial Demonstration Program and User Data Distribution System were discussed at length. Commander Honhart, of FNWC, discussed their current status in the program and their plans to continue on schedule with the data distribution system and processing the existing SEASAT data set.

After the presentations concerning the SEASAT-A Program were made by individuals from JPL and NASA, the experimenters were given the opportunity to make remarks, observations, discuss collected surface truth data and provide direct

input for the planning for modification and reorganization of the experiment program. The experimenters were organized into three groups to discuss the original experiment objectives which could still be realized, their data requirements and changes resulting from the satellite failure, comments, commitments and support to continue the SEASAT-A Commercial Demonstration Program.

On the following day, Wednesday, 1 November, reports summarizing the discussion group's findings were presented to the entire group and the meeting opened to further discussion. The two-day meeting was concluded with remarks by Mr. Montgomery reiterating the current status of the SEASAT-A program and thanking the experimenters for their inputs into the reorganization plan.

The discussion/working groups were organized into three interest groups:

1. Offshore Oil, Gas and Ocean Mining
2. Fisheries
3. Marine Transportation, Safety and Ice Conditions.

The general conclusion of the three user groups was that although the SEASAT-A satellite had failed after 106 days of operation, the overall objectives of the Commercial Demonstration Program could and should be fulfilled. It appears that many of the planned experiments could be completed with minimal changes using the existing SEASAT-A data set and data distribution system. Many of the experimenters operate in areas of the world where little or no historical data or reliable forecasting products are available. SEASAT-A provided a unique set of data that would not otherwise be available to the marine industrial community. The general consensus of the participants at the meeting was that the maritime and offshore industries had made a commitment to the SEASAT-A program concept and they wanted to continue to be partners with NASA in an oceans program.

The industrial representatives emphasized that they wanted the existing SEASAT-A data set processed and made available to them as soon as possible in order to evaluate the data relative to their operations. The evaluation of the UDDS is essential to establishing the utility of a real-time data distribution system. A summarization of the modified SEASAT-A Commercial Demonstration Program is provided in Table 1. Each of the original twenty-two experiments are noted in terms of desired data and original objectives which could be accomplished within the structure of a modified program plan.

Mr. Siapno, of Deep Sea Ventures, Inc., discussed the importance of obtaining reliable and timely weather and surface data for any maritime operations in the Pacific. Mr. Siapno suggested the following uses of the existing SEASAT-A data set and UDDS:

1. Evaluate the potential impact of SEASAT-A data of storms which did occur at mining sites.
2. Evaluate SEASAT-A capabilities to determine storm formation and progression.
3. Include NIMBUS, GOES and any other available data into the WEATHERFAX to improve forecasts.

The specific conclusion of the Offshore Oil, Gas and Ocean Mining group meeting was to request that any other available satellite data such as NIMBUS and GEOS should be incorporated into the real-time products available to the industry users from FNWC. The highest priority for this group of experimenters is the evaluation of the UDDS and its impact upon maritime commerce and operations.

The Fisheries group reported similar conclusions with continuing support for the evaluation of the existing SEASAT-A data set and evaluation of the UDDS. The utility of the SEASAT-A data can be evaluated in the fisheries experiments where good surface truth and catch distribution data bases exist. The fisheries are

TABLE 1 MODIFIED SEASAT-A DEMONSTRATION PROGRAM

EXPERIMENT TITLE	PARTICIPATING ORGANIZATIONS	PRINCIPAL CONTACT	LOCATION	CONTINUED PARTICIPATION	USER COLLECTED SURFACE TRUTH	DESIRED DATA	FUTURE ACTIVITY INTEREST
1 BEAUFORT SEA (OIL & GAS & ARCTIC OPERATION)	1 ARCTIC PETROLEUM OPERATOR S ASSOCIATION AND ALASKA OIL AND GAS ASSOCIATION ESSO RESOURCES CANADA CANADA MARINE DRILLING	T HUDSON B SPEDDING C DAVID B WRIGHT	a) 126° - 140°W COAST - LAT > 1° SOM b) COAST - 72°N 125° - 140 W	YES	WIND AND WAVE DATA FROM PLATFORMS IN BEAUFORT SEA	SEASAT NRT WIND AND WAVE OBSERVATION SAR OBSERVATION OF BEAUFORT SEA R/T FNWC ANALYSIS AND PROGS	COMPARE PLATFORM MEASUREMENT WITH SEASAT DATA DETERMINE LEVEL OF CORRELATION ASSESS ABILITY OF SEASAT DATA TO EFFECT BEAUFORT SEA DRILLING OPERATIONS
2 LABRADOR SEA (OIL & GAS & PIPELINES)	2 EAST COAST PETROLEUM OPERATORS ASSOCIATION EASTCAN EXPLORATION ESSO RESOURCES CANADA TEXACO	P BUTMI C SPEDDING G F MOTI/O MACY	60° - 65°N COAST 55°W	YES	BUOY DATA FROM EAST LABRADOR SEA	SEASAT NRT WIND WAVE AND SAR OBSERVATION OF LABRADOR SEA SOME R/T FNWC ANALYSIS AND PROGS	COMPARE BUOY DATA WITH SEASAT DATA - DETERMINE LEVEL OF CORRELATION ASSESS ABILITY OF SEASAT DATA TO EFFECT LABRADOR SEA SHIP DRILLING OPERATIONS
3 GULF OF MEXICO (OIL & GAS & PIPELINE)	3 AMERICAN GAS ASSOCIATION		NORTHERN HALF GULF OF MEXICO	UNKNOWN	UNKNOWN	TBD	TBD
4 U S EAST COAST	4 CONTINENTAL OIL COMPANY	F ROSE	a) GEORGES BANK b) BALTIMORE CANYON TROUGH c) GEORGIAN EMBAYMENT	YES	WIND, WAVE, TEMPERATURE DATA FROM PLATFORM IN BALTIMORE CANYON	SEASAT NRT WIND AND WAVE OBSERVATION PLUS SAR IMAGES OF U S EAST COAST	COMPARE PLATFORM MEASUREMENT WITH SEASAT DATA DETERMINE LEVEL OF CORRELATION ASSESS ABILITY OF SEASAT DATA TO EFFECT EXPLORATION DRILLING OPERATIONS IN BALTIMORE CANYON ASSESS EFFECTIVENESS OF R/T PROCESSING DISTRIBUTION SYSTEM
5 OFFSHORE WEST AFRICA (OIL & GAS & DRILLING)	5 GETTY OIL CO	H A DEMIRJIAN	a) 12°N - 7°S 15°E - 30°W b) 14° - 16°S 124° - 126°E	YES	LIMITED COMMERCIAL ANALYSES AND FORECASTS	SEASAT NRT WIND AND WAVE MEASUREMENTS IN SEVERAL SELECTED REGIONS R/T FNWC WIND AND WAVE ANALYSIS AND PROGS	LIMITED ANALYSIS OF SEASAT DATA VERSUS SURFACE ANALYSIS TO ASSESS LEVEL OF CORRELATION AND EFFECT ON OFF SHORE DRILLING ACTIVITIES STRONG IN EFFORT IN DEVELOPING IN HOUSE SKILLS TO USE SATELLITE DATA IN OCEANOGRAPHIC ANALYSIS
6 EQUATORIAL EAST PACIFIC OCEAN MINING	6 DEEPSEA VENTURES, INC KENNECOTT EXPLORATION INC INTERNATIONAL NICKEL CO , INC LOCKHEED OCEAN	W SIAPNO	5° - 20°N 110° - 150°W	YES	WIND WAVE AND OTHER MET DATA IN EASTERN TROPICAL PACIFIC	SEASAT NRT WIND AND WAVE DATA OF HURRICANE DEVELOPMENTS IN PACIFIC POSSIBLE R/T FNWC PRODUCTS DURING SUMMER OF 1978	COMPARE SHIP OBSERVATIONS WITH SEASAT DATA DETERMINE LEVEL OF CORRELATION WITH EMPHASIS ON HURRICANE FORMATION AND TRACK ASSESS EFFECTIVENESS OF R/T PROCESSING AND DISTRIBUTION SYSTEM
7 BERING SEA (OIL & GAS)	7 ALASKA OIL AND GAS ASSOCIATION, ARCTIC RESEARCH SUBCOMMITTEE	F NG	OFFSHORE ALASKA	UNKNOWN	UNKNOWN	TBD	TBD
8 NORTH SEA (OIL & GAS)	8 UNION OIL CO CONTINENTAL OIL CO	M OTT F ROSE	BRENT 61° - 2°E FORTIES 58°N - 1°E FRIGG 60°N 2°E FORMA 60°N - 3°W	YES	YES	SEASAT NRT WIND AND WAVE MEASUREMENTS IN NORTH SEA	COMPARE PLATFORM MEASUREMENT WITH SEASAT DATA DETERMINE LEVEL OF CORRELATION WITH EMPHASIS ON HURRICANE FORMATION AND TRACK ASSESS ABILITY OF SEASAT DATA TO EFFECT NORTH SEA PRODUCTION OPERATIONS

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TABLE 1 MODIFIED SEASAT-A DEMONSTRATION PROGRAM (CONTINUED)

EXPERIMENT TITLE	PARTICIPATING ORGANIZATIONS	PRINCIPAL CONTACT	LOCATION	CONTINUED PARTICIPATION	USER COLLECTED SURFACE TRUTH	DESIRED DATA	FUTURE ACTIVITY INTEREST
9 MARINE ENVIRONMENTAL FORECASTING IN NORTH SEA	9 OCEANROUTES, INC	R MAYER	45° - 70°N 15°W - 15°E	YES	WIND WAVE AND OTHER MET DATA, WORLDWIDE, CONCENT CONCENTRATION IN MAJOR SHIPPING LANES	SEASAT NRT WIND WAVE AND TEMPERATURE MEASUREMENTS--BOTH HEMISPHERES POSSIBLE R/T FNMC PRODUCTS	COMPARE SURFACE OBSERVATIONS WITH SEASAT DATA THROUGH SIMULATION ASSESS IMPACT OF SEASAT DATA ON OPTIMUM SHIP ROUTE PREPARATION
10 OCEAN THERMAL POWER	10 OCEAN DATA SYSTEMS, INC	P WOLFF	OFFSHORE POINTS IN U S EAST AND WEST COASTS	YES	WIND, WAVE AND OTHER MET DATA WORLDWIDE	SEASAT NRT WIND WAVE AND TEMPERATURE MEASUREMENTS	ANALYZE SEASAT TEMPERATURE DATA TO AID IDENTIFICATION OF POTENTIAL SITES FOR OCEAN THERMAL ENERGY FACILITIES ASSESS ABILITY OF SEASAT DATA TO IMPROVE OCEAN FORECASTS
11 ICE MONITORING FOR TANKER DESIGN	11 SUN SHIPBUILDING AND DRY DOCK CO	G CHRISTOPH		TBD			
12 SHIP NAVIGATION & SIMULATION	12 SUN SHIPBUILDING AND DRY DOCK CO	G CHRISTOPH	SHIPPING LANES BETWEEN TACOMA, WASHINGTON AND ANCHORAGE, ALASKA	YES	SHIP OBSERVATIONS OF WIND AND WAVE CONDITIONS IN GULF OF ALASKA	SEASAT NRT WIND AND WAVE DATA IN GULF OF ALASKA POSSIBLE R/T FNMC PRODUCTS	USE SEASAT DATA IN ROUTE SIMULATION MODEL TO DETERMINE OPTIMUM ROUTE AND POWER SETTINGS
13 INTERNATIONAL ICE PATROL NORTHERN SURVEY	13 INTERNATIONAL ICE PATROL (USCG)		COAST OF LABRADOR AND BAFFIN ISLANDS	TBD			
14 INTERNATIONAL ICE PATROL DRIFT ANALYSIS	14 INTERNATIONAL ICE PATROL DRIFT ANALYSIS		GRAND BANKS	TBD			
15 INTERNATIONAL ICE PATROL ENVIRONMENTAL SURVEY	15 INTERNATIONAL ICE PATROL ENVIRONMENTAL SURVEY		43° - 49°N 44° 50°W	YES	WIND, WAVE AND TEMPERATURE DATA FROM OCEANOGRAPHIC CUTTER IN GRAND BANKS	SEASAT NRT WIND WAVE AND TEMPERATURE DATA OF GRAND BANKS	USE SEASAT DATA IN ICEBERG DRIFT MODEL TO DETERMINE IF DRIFT PREDICTIONS IMPROVED
16 OPTIMUM SHIP ROUTING	16 OCEAN ROUTES, INC	R MAYER	70°N - 60°S 0 360° LONG	POSSIBLY	UNKNOWN	TBD	TBD
17 ALASKA CRAB FISHERIES	17 NORTH PACIFIC FISHING VESSEL OWNERS ASSOCIATION	S JAEGER	GULF OF ALASKA AND BERING SEA	POSSIBLY	LIMITED INFORMATION IN SHIPS LOGS	TBD	TBD
18 ALASKA CRAB FISHERIES	18 KODIAK	F BOHANNON	a) 50°N - 62°N 140°W - 160°W b) 50° - 65°N 160° - 175°W	POSSIBLY	UNKNOWN	TBD	TBD
19 TROPICAL TUNA FISHERIES	19 PACIFIC COAST TUNA & ALBACORE	M LAURS	COAST OF CHILE NORTH TO NORTHERN CALIFORNIA 100 1000 OFFSHORE MILES	YES	WIND, WAVE AND TEMPERATURE DATA FROM FISHERIES RESEARCH VESSELS ALONG U S WEST COAST ALSO VESSEL CATCH STATISTICS	SEASAT NRT WIND, WAVE AND TEMPERATURE DATA IN TROPICAL PACIFIC AND U S WEST COAST POSSIBLE R/T FNMC	COMPARE SEASAT WIND, WAVE AND TEMPERATURE DATA WITH RESEARCH SHIP OBSERVATIONS ASSESS THROUGH SIMULATIONS, ABILITY OF SEASAT DATA TO EFFECT VESSEL EFFICIENCY AND CATCH STATISTICS
20 SALMON--ALBACORE	20 PACIFIC COAST SALMON & BOTTOM FISH VESSELS/OREGON STATE UNIVERSITY AND HUMBOLT STATE UNIVERSITY	R JACOBSON F JURICK	OFFSHORE SE ALASKA TO GUADALOPE ISLAND	POSSIBLY	UNKNOWN	TBD	TBD
21 GOOSE NESTING	21 FISH & WILDLIFE SERVICE			NO			
22 ATMOSPHERIC & ENVIRONMENTAL SERVICE (CANADA)	22 ATMOSPHERIC & ENVIRONMENTAL SERVICE (CANADA)	S PETEHERYCH	45 60°N, 125 155°W 68 75°N, 115 142 W 20 - 65°N 30° 67°W	YES	MET DATA IN NORTHERN HEMISPHERE	SEASAT NRT WIND, WAVE AND TEMPERATURE DATA IN NORTHERN HEMISPHERE	INTRODUCE SEASAT DATA INTO PREVIOUS CANADIAN ANALYSIS AND FORECAST PRODUCTS ASSESS ABILITY OF SEASAT OBSERVATIONS TO IMPROVE FORECAST PRODUCTS

most interested in access to the FNWC real-time products particularly with a finer grid (125 x 125; zoom 512 x 512) which Commander Honhart said was to be available.

The Marine Transportation, Safety and Ice Operations Group want all of the existing SEASAT-A data processed and made available as soon as possible. As the algorithms are improved the data should be reprocessed and redistributed. A proposal was offered by which FNWC would process the SEASAT-A data until a "satisfactory" algorithm was obtained, then distribute the data to the users. The group requested that all synoptic observation data corresponding to SEASAT-A be preserved. The SAR data over water and ice is of great importance to this group, and it was suggested that NASA should look into the possibility of producing real-time ice distribution maps utilizing the NIMBUS SMMR and distributing these maps using the UDDS.

In summary, the industry experimenters strongly supported the continuation of the program with the specific objectives of evaluating the SEASAT-A data set and the UDDS. All of the experimenters present indicated a desire to continue in the experiment program, and many of the experimenters indicated that the objectives of their experiments could be fulfilled by evaluation of the SEASAT-A data set and the UDDS. The need for quick dissemination of the SEASAT-A data set for evaluation by industry experimenters was stressed. The experimenters urged that NASA explore the possibility of adding other satellite products to the data processed by FNWC for inclusion in the data products distributed by the UDDS.

3. SEASAT-A PERFORMANCE EVALUATION

3.1 Sensor Performance Summary

Dr. Dunne of JPL discussed the status of the sensor engineering assessment. The sensor assessment is still being conducted at JPL and the evaluation is expected to be completed by September 1979.

To date it is known that a few in-flight sensor problems did exist. The altimeter microprocessor had a software bug which was not corrected before the failure. The VIRR malfunctioned early in the mission however excellent images of Hurricane Fico west of Baja, California toward Hawaii were received when all sensors were operating. Scatterometer data covered the hurricane's eye on 20 September 1978. Surface truth data is available for this particular storm and is being utilized in the evaluation of the SEASAT remote-sensed data. The altimeter and VIRR-returned data for 70 and 52 days, respectively.

The SAR performance appears to have been very good and the evaluation of the resolution is currently being conducted. The SAR completed 500 data-gathering passes during which it collected about 60 hours of data. SAR images were on display in the meeting room though the actual system resolution of 25m was not shown because of limitations of the film processing equipment. Altimetric data obtained over the Pacific in July achieved the designed data precision and is considered a major improvement over the current GEOS data.

In summary, the sensors generally worked well during the 106 operational days of SEASAT-A. The principal data loss due to the premature spacecraft failure is the ability to compare data collected over several seasons of spacecraft operation.

3.2 Characteristics of Existing SEASAT-A Data Set

Mr. Pounder of JPL reviewed the profile of the existing SEASAT data set. The satellite lifetime was from 27 June until 10 October 1978 when the power failure occurred. The Data Timeline, Figure 1, outlines the 106 days of operation and the number of passes with each sensor.

Maneuvers were conducted at day 230 when the 17-day orbit was changed to the 3-day orbit, with a further maneuver again at day 253. The VIRR scanner failed at day 240 and the altimeter experienced problems during days 198-207. A data processing backlogging problem at GSFC was being solved at the time of the failure.

Dr. Ferrari of JPL continued the technical presentation of the existing data set with a set of slides outlining the geographical characteristics of the sensor coverage and more specifics on the available SEASAT-A data set.

Sensors were described in terms of measurements, footprints and data frequencies as shown in Table 2. A brief discussion followed outlining the one-day coverage at the equatorial, middle and polar latitudes for each sensor's footprint, Figures 2 through 10, and the number of existing SEASAT-A observations in the data set.

Further explanation of the actual SEASAT-A coverage for the Atlantic and Pacific Oceans during particular orbit days was discussed in order to provide the experimenters with a specific idea as to the SEASAT-A data which could be made available to them. Slides were used to illustrate the coverage of the SEASAT-A SAR over Fairbanks, Alaska, Figure 18; Oakhanger, U.K., Figure 19; St. John's, Newfoundland, Figure 20; Goldstone, California, Figure 21; and Merritt Island, Florida, Figure 22.

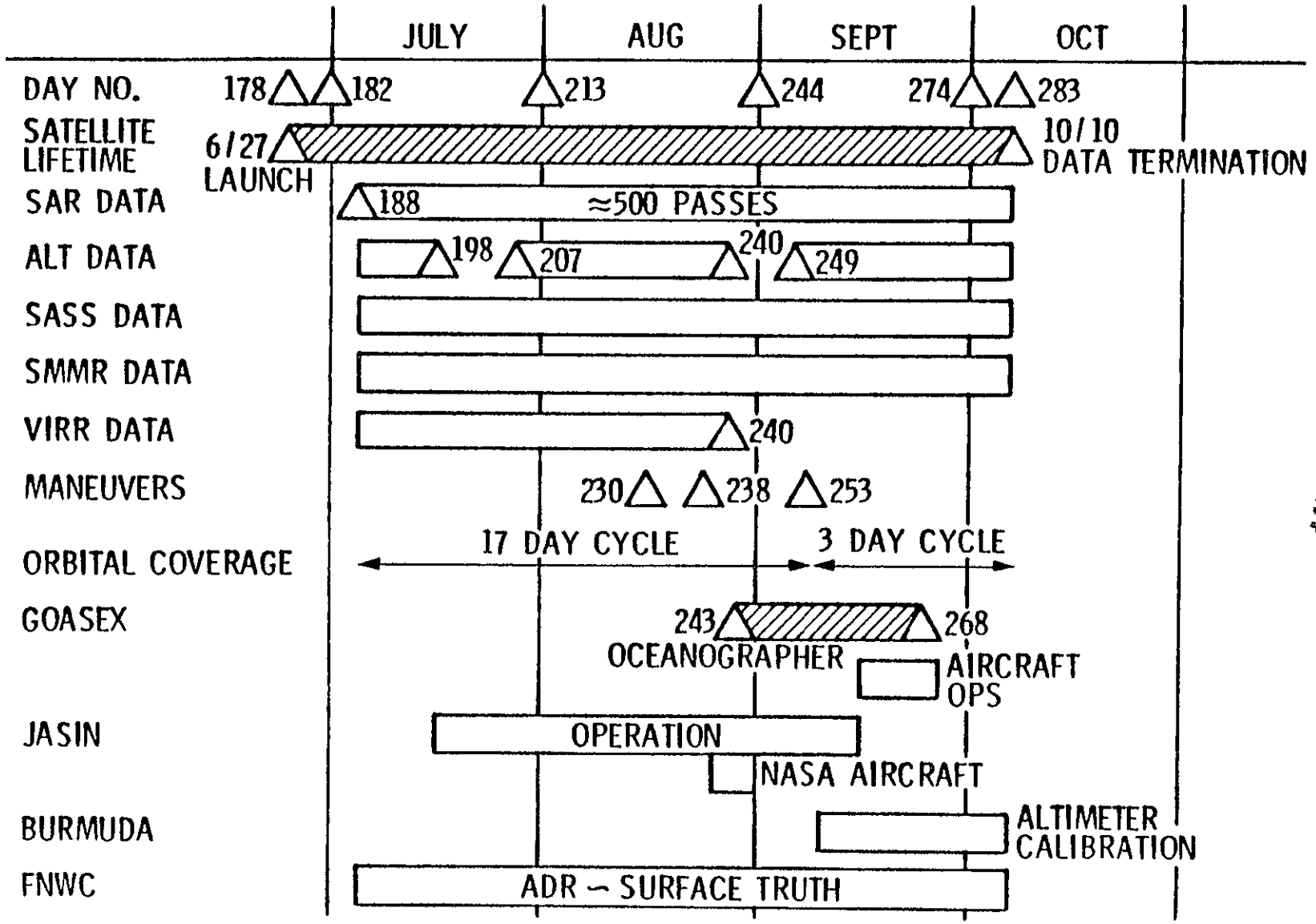

FIGURE 1 SEASAT-A DATA TIMELINE

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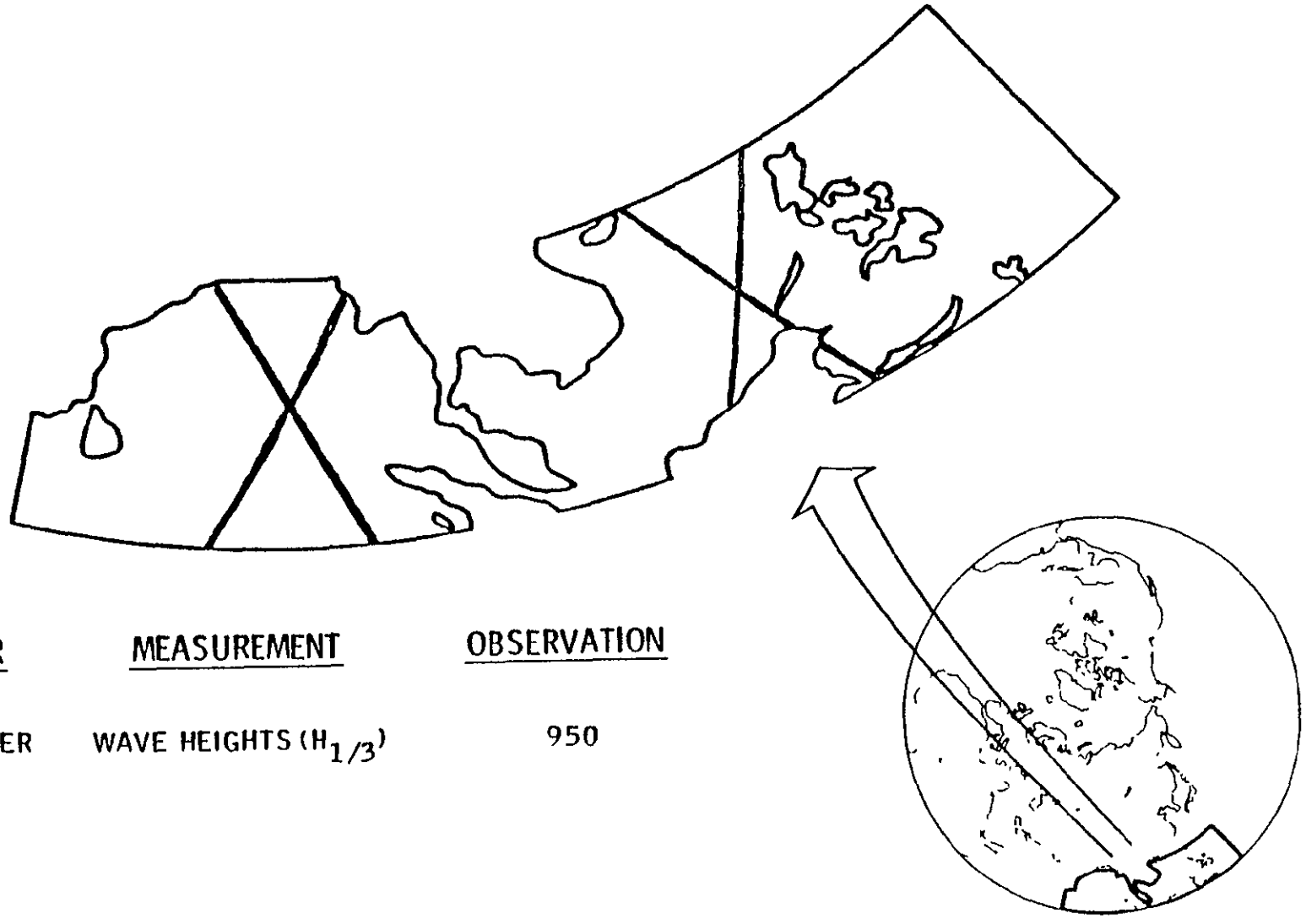
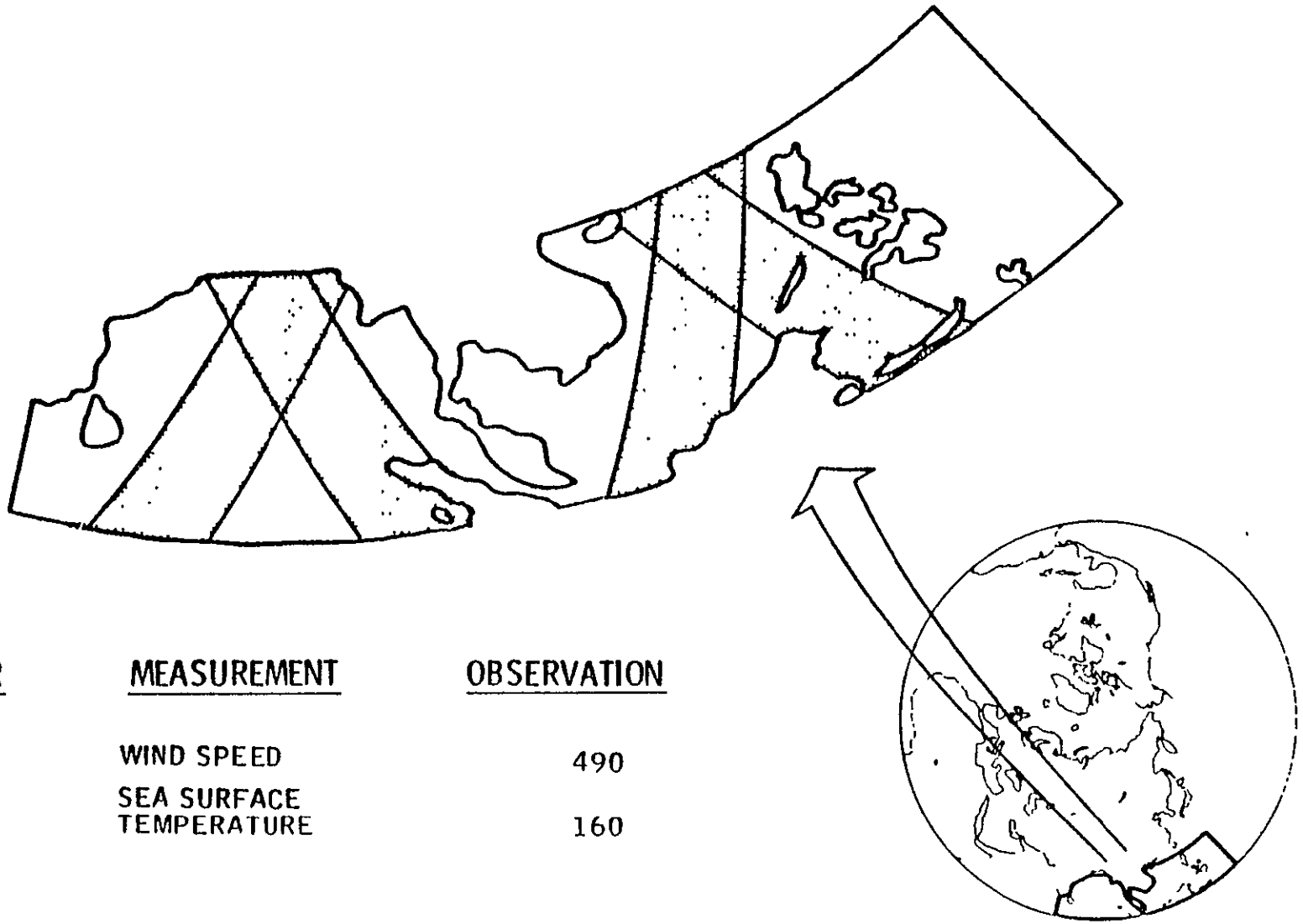
TABLE 2 SEASAT-A GEOPHYSICAL DATA CHARACTERISTICS

SENSOR	MEASUREMENT	FOOTPRINT	FREQUENCY
ALTIMETER	WAVE HEIGHTS ($H_{1/3}$)	APPROX 2 km IN DIA	2 sec
SMMR	① SEA SURFACE TEMPERATURE (SST)	SQUARE ARRAY 600 km BY 600 km:	
		4 x 4 = 16 POINTS (SST)	90 sec
	② SEA SURFACE WIND MAGNITUDE (SSW)	7 x 7 = 49 POINTS (SSW)	90 sec
SASS	WIND MAGNITUDE AND DIRECTION	TWO 500 km SWATHS WITH 50 km BY 50 km RESOLUTION	7.5 sec
SAR	IMAGERY	100 km SWATH	—



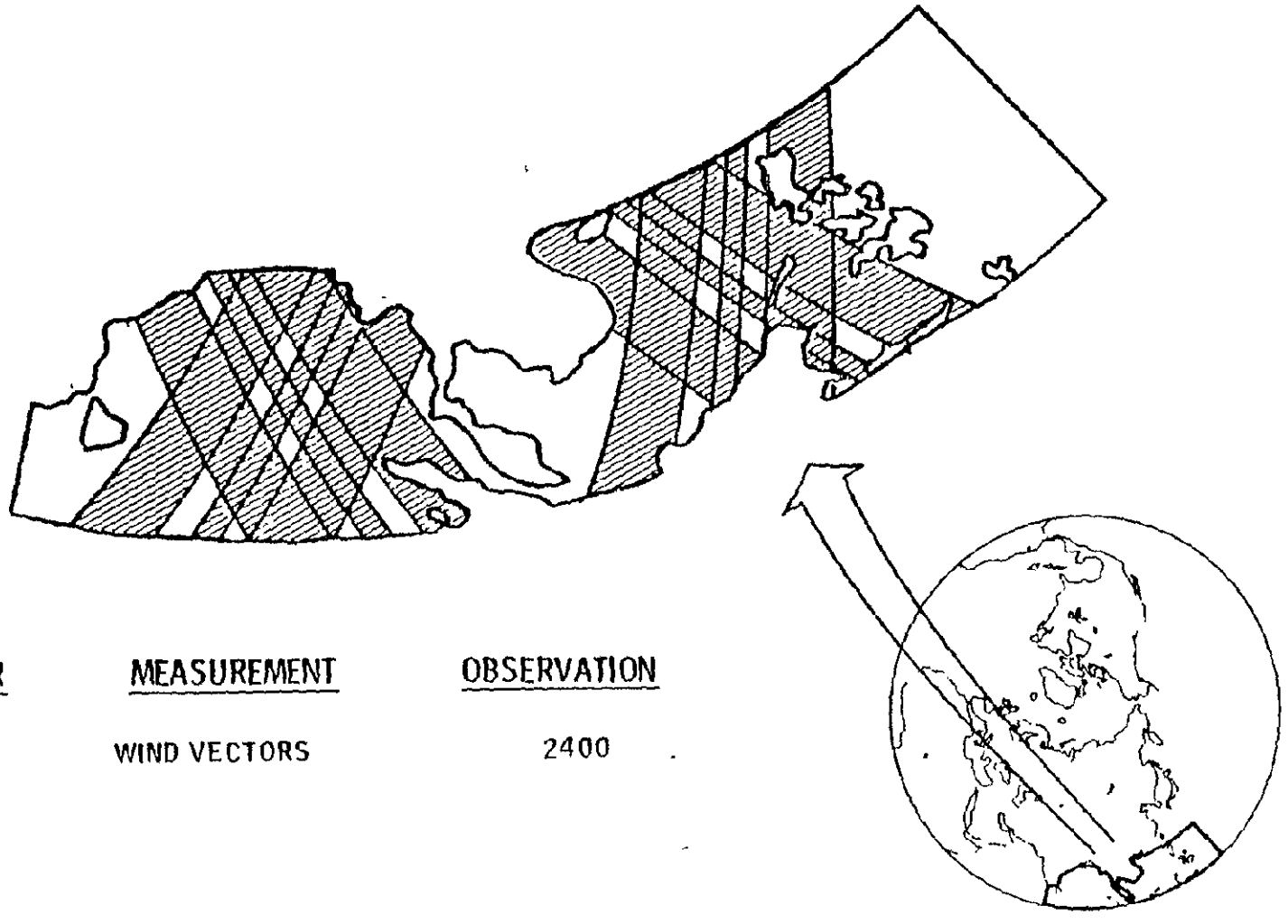
SENSOR	MEASUREMENT	OBSERVATION
ALTIMETER	WAVE HEIGHTS ($H_{1/3}$)	950

FIGURE 2 SEASAT-A ONE DAY DATA COVERAGE - EQUATORIAL LATITUDES - ALTIMETER



SENSOR	MEASUREMENT	OBSERVATION
SMMR	WIND SPEED	490
	SEA SURFACE TEMPERATURE	160

FIGURE 3 SEASAT-A ONE DAY DATA COVERAGE - EQUATORIAL LATITUDES - SMMR



SENSOR	MEASUREMENT	OBSERVATION
SASS	WIND VECTORS	2400

FIGURE 4 SEASAT-A ONE DAY DATA COVERAGE - EQUATORIAL LATITUDES - SASS

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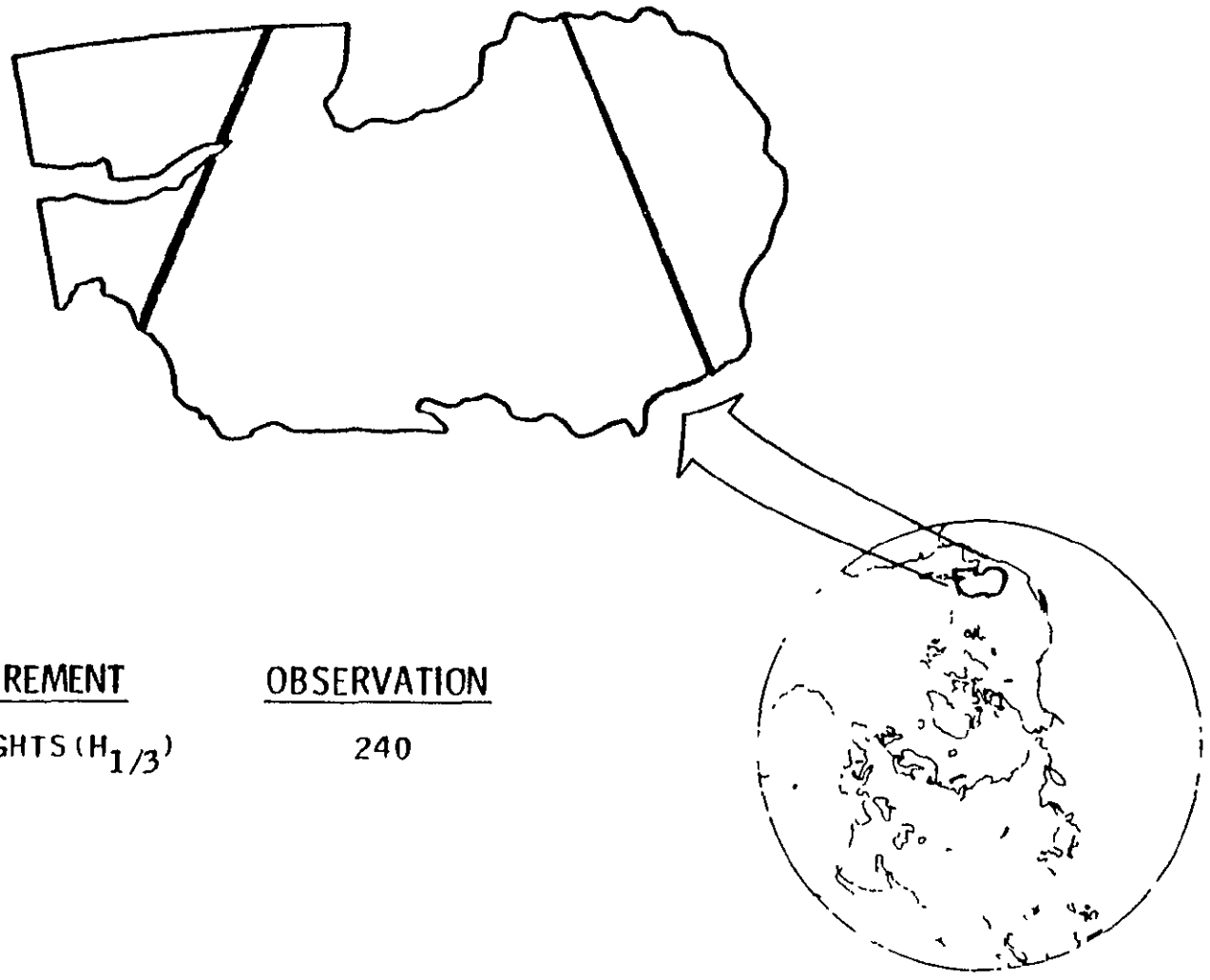
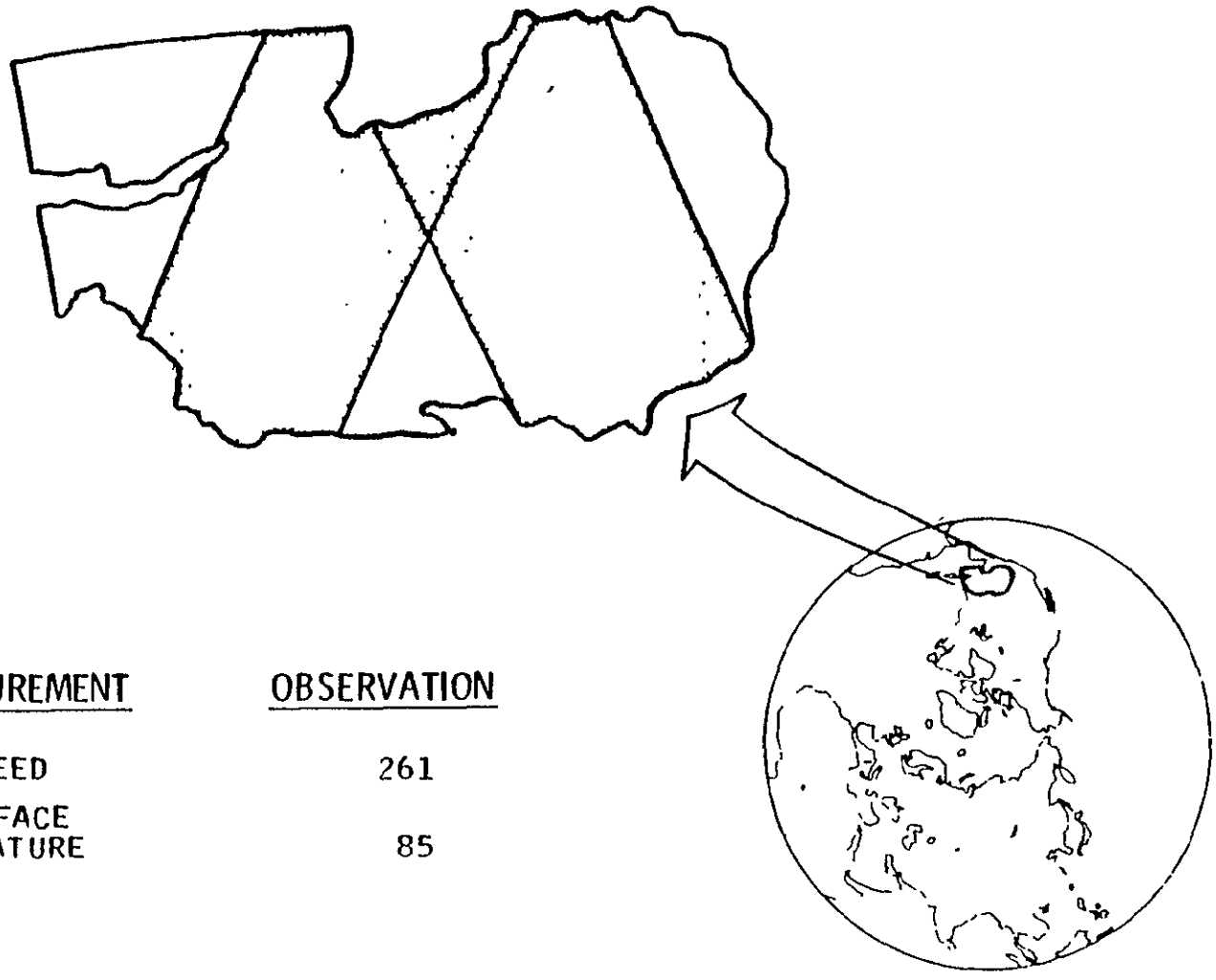


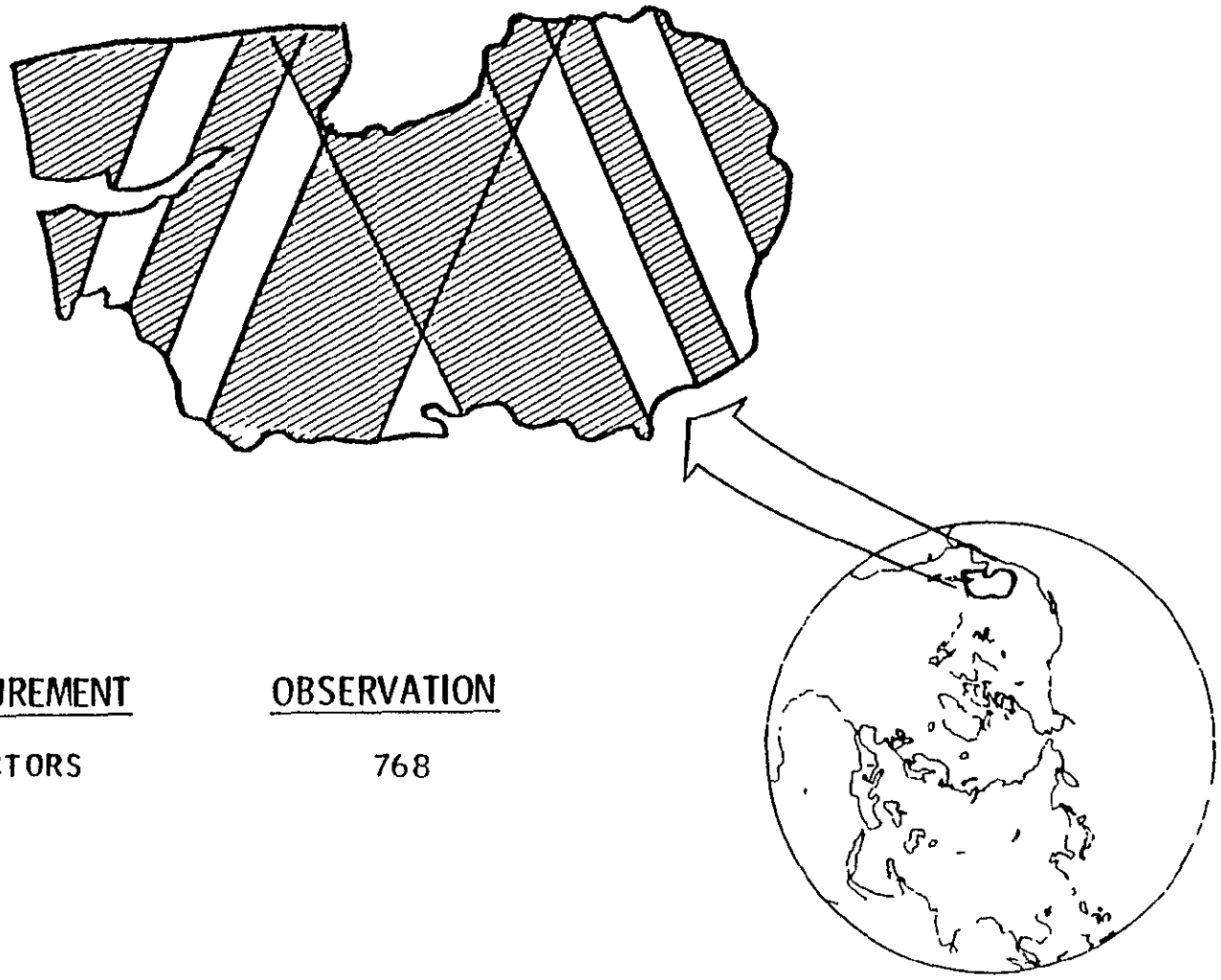
SENSOR	MEASUREMENT	OBSERVATION
ALTIMETER	WAVE HEIGHTS ($H_{1/3}$)	240

FIGURE 5 SEASAT-A ONE DAY DATA COVERAGE - MIDDLE LATITUDES - ALTIMETER



SENSOR	MEASUREMENT	OBSERVATION
SMMR	WIND SPEED	261
	SEA SURFACE TEMPERATURE	85

FIGURE 6 SEASAT-A ONE DAY DATA COVERAGE - MIDDLE LATITUDES - SMMR



SENSOR	MEASUREMENT	OBSERVATION
SASS	WIND VECTORS	768

FIGURE 7 SEASAT-A ONE DAY DATA COVERAGE - MIDDLE LATITUDES - SASS

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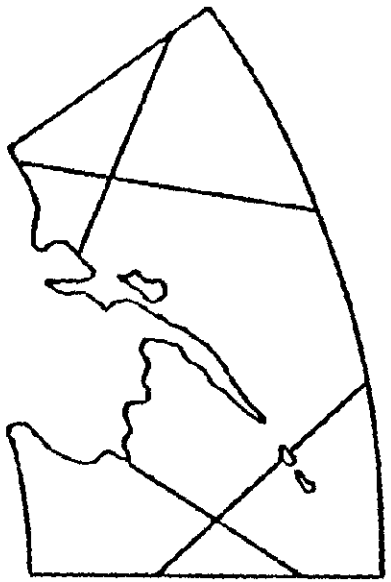

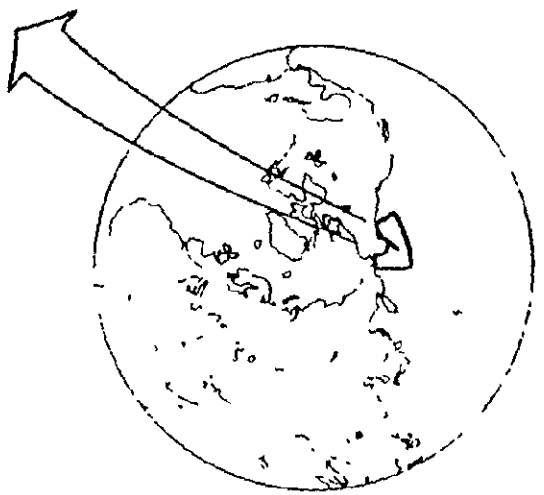

SENSOR	MEASUREMENT	OBSERVATION
ALTIMETER	WAVE HEIGHTS ($H_{1/3}$)	405

FIGURE 8 SEASAT-A ONE DAY DATA COVERAGE - POLAR LATITUDES - ALTIMETER

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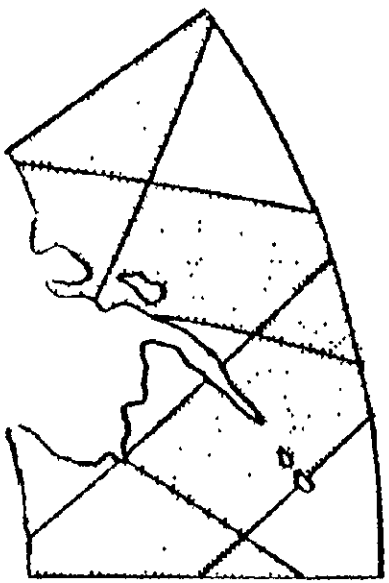
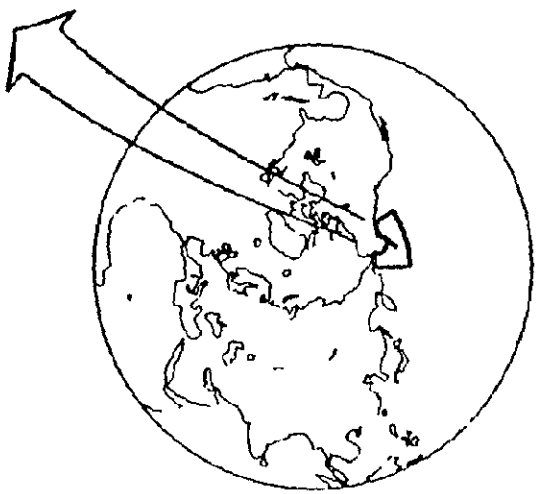
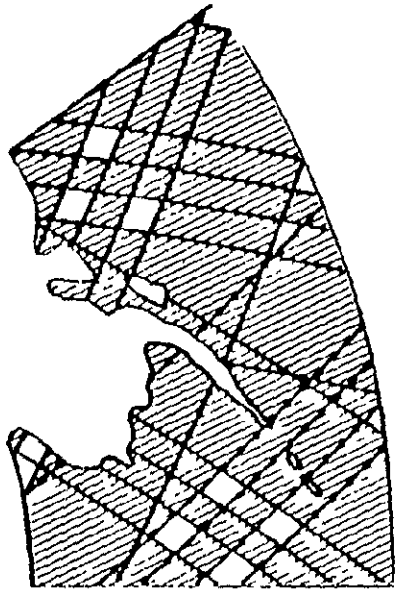




SENSOR	MEASUREMENT	OBSERVATION
SMMR	WIND SPEED	333
	SEA SURFACE TEMPERATURE	108

FIGURE 9 SEASAT-A ONE DAY DATA COVERAGE - POLAR LATITUDES - SMMR



SENSOR	MEASUREMENT	OBSERVATION
SASS	WIND VECTORS	1620

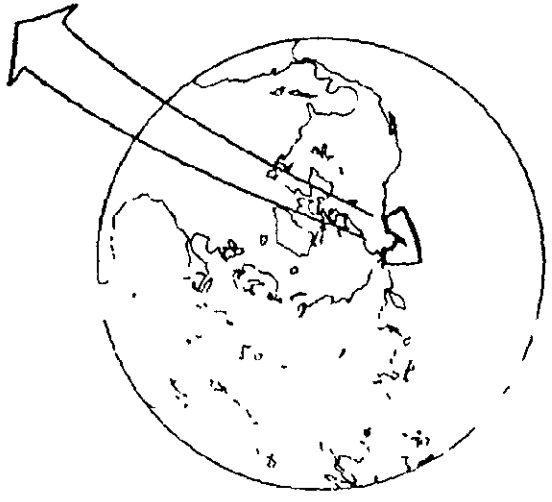


FIGURE 10 SEASAT-A ONE DAY DATA COVERAGE - POLAR LATITUDES - SASS

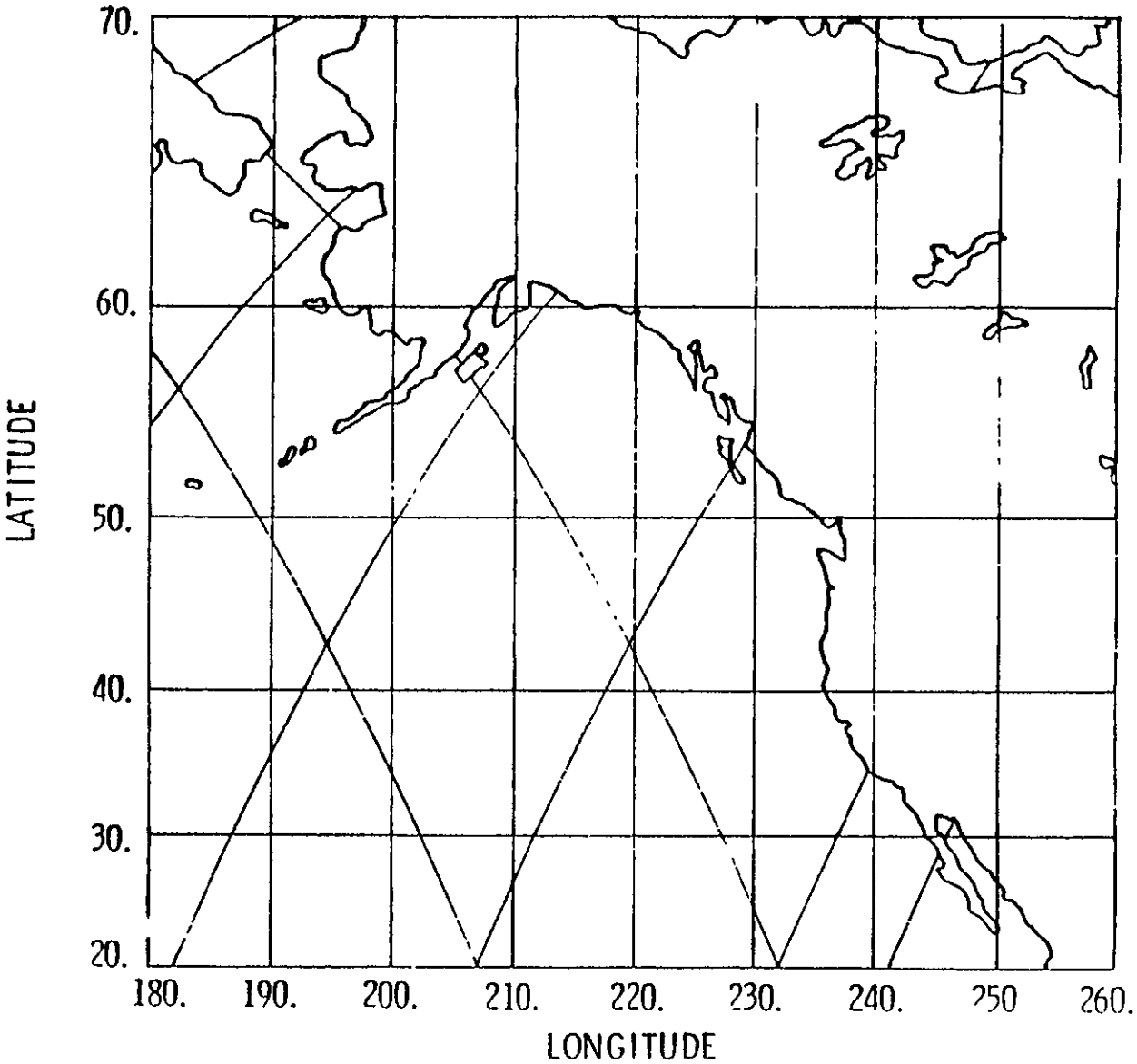


FIGURE 11 SEASAT-A LAUNCH ORBIT - 1 DAY COVERAGE

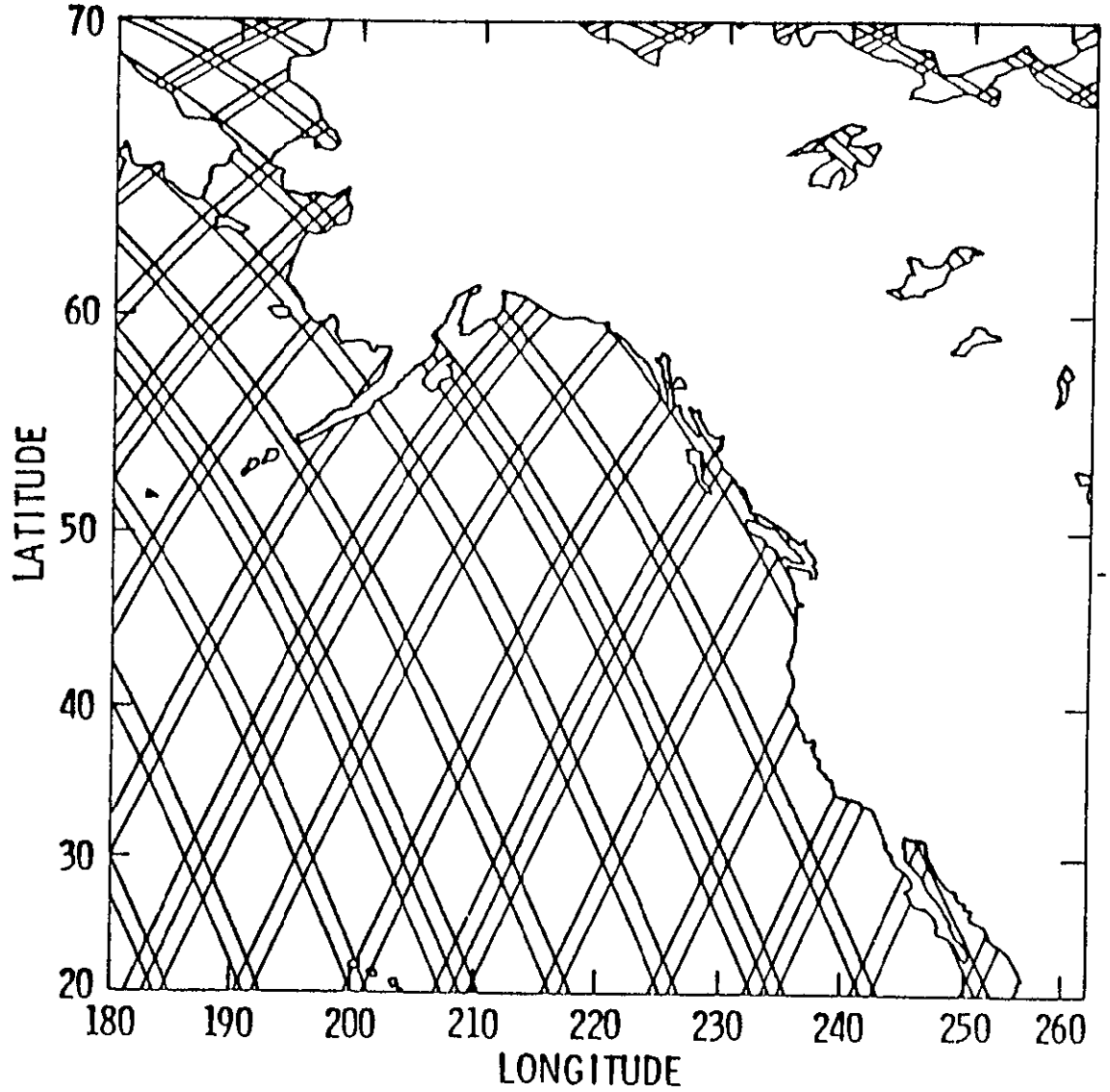


FIGURE 12 SEASAT-A LAUNCH ORBIT - 7 DAY COVERAGE

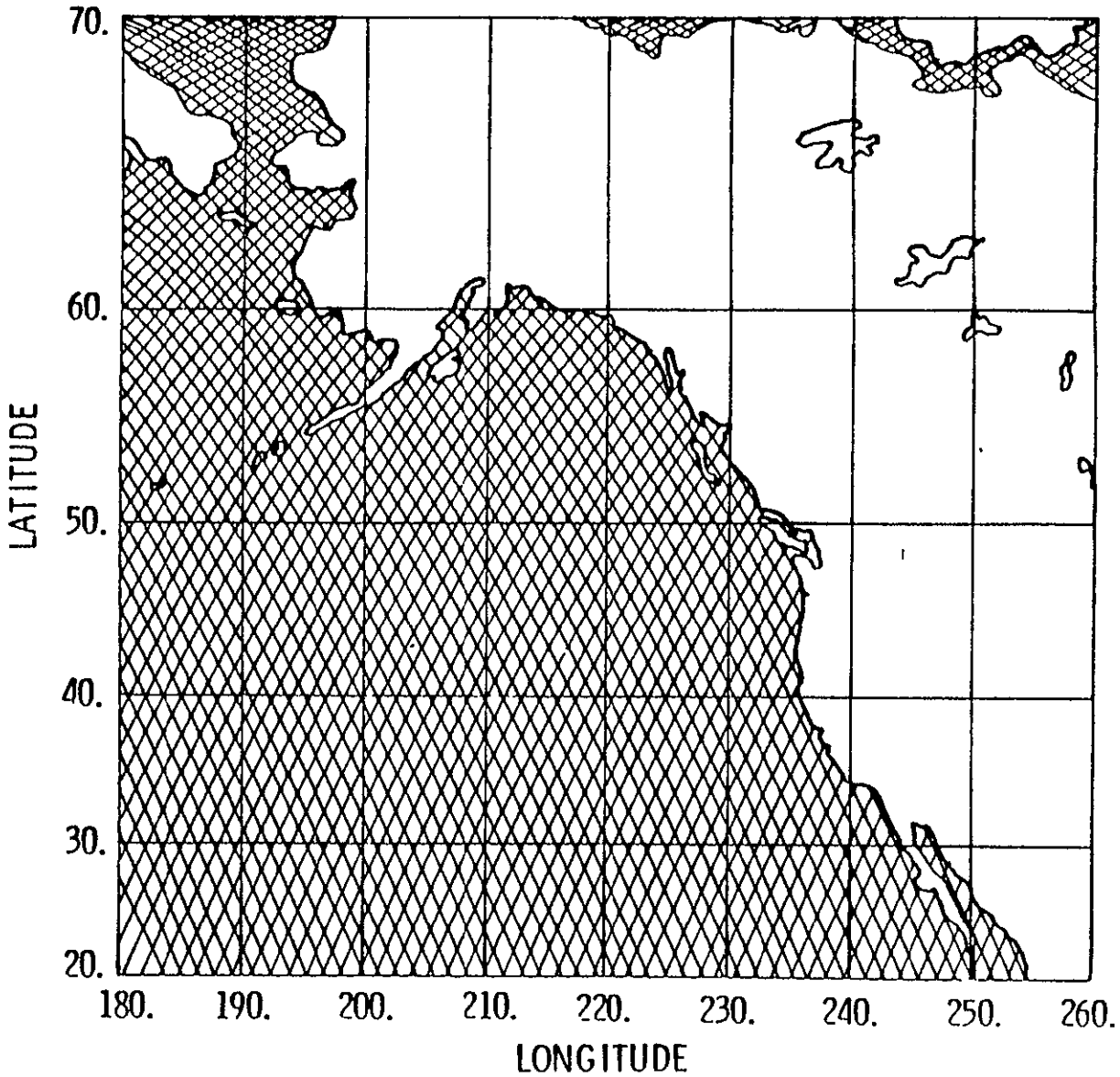


FIGURE 13 SEASAT-A LAUNCH ORBIT - 17 DAY CYCLE

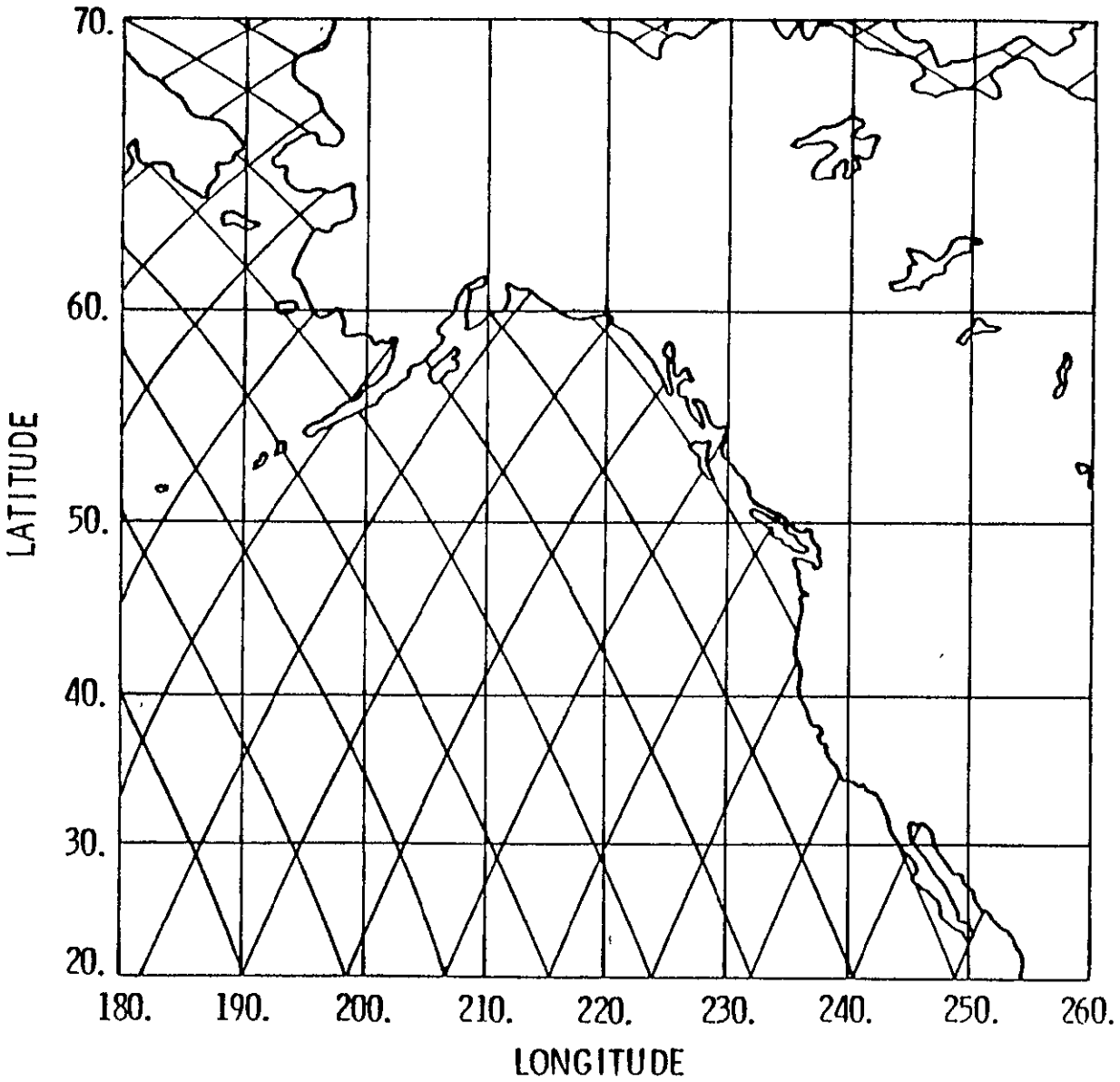


FIGURE 14 SEASAT-A BERMUDA OVERFLIGHT - 3 DAY COVERAGE

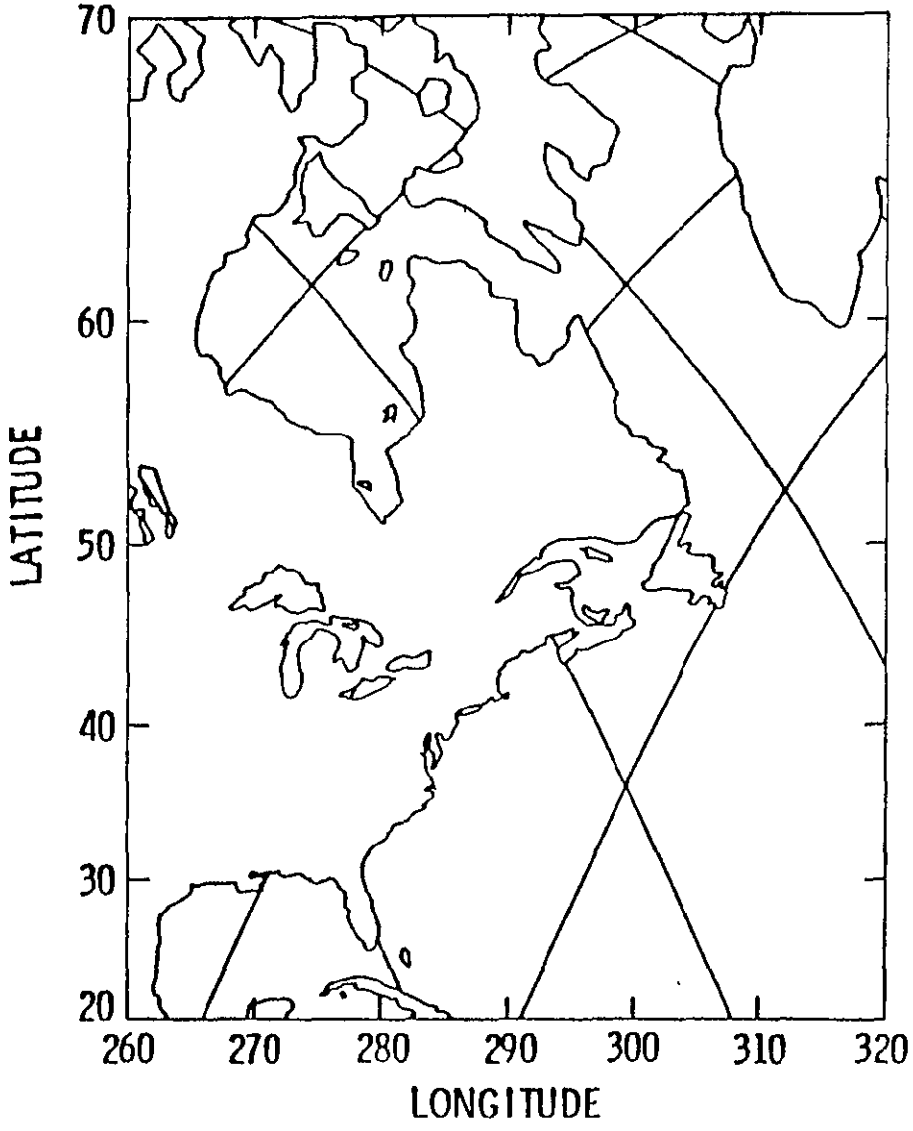


FIGURE 15 SEASAT-A LAUNCH ORBIT - 1 DAY COVERAGE

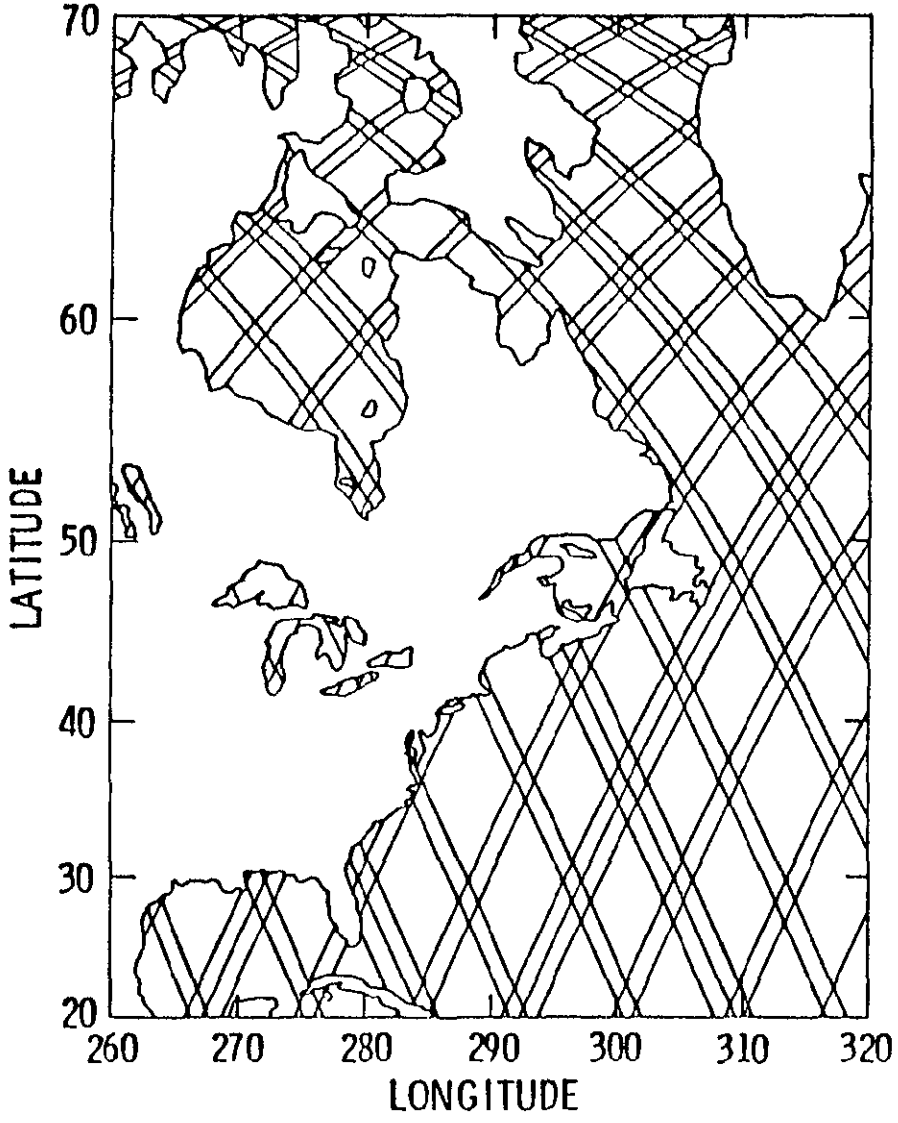


FIGURE 16 SEASAT-A LAUNCH ORBIT - 7 DAY COVERAGE

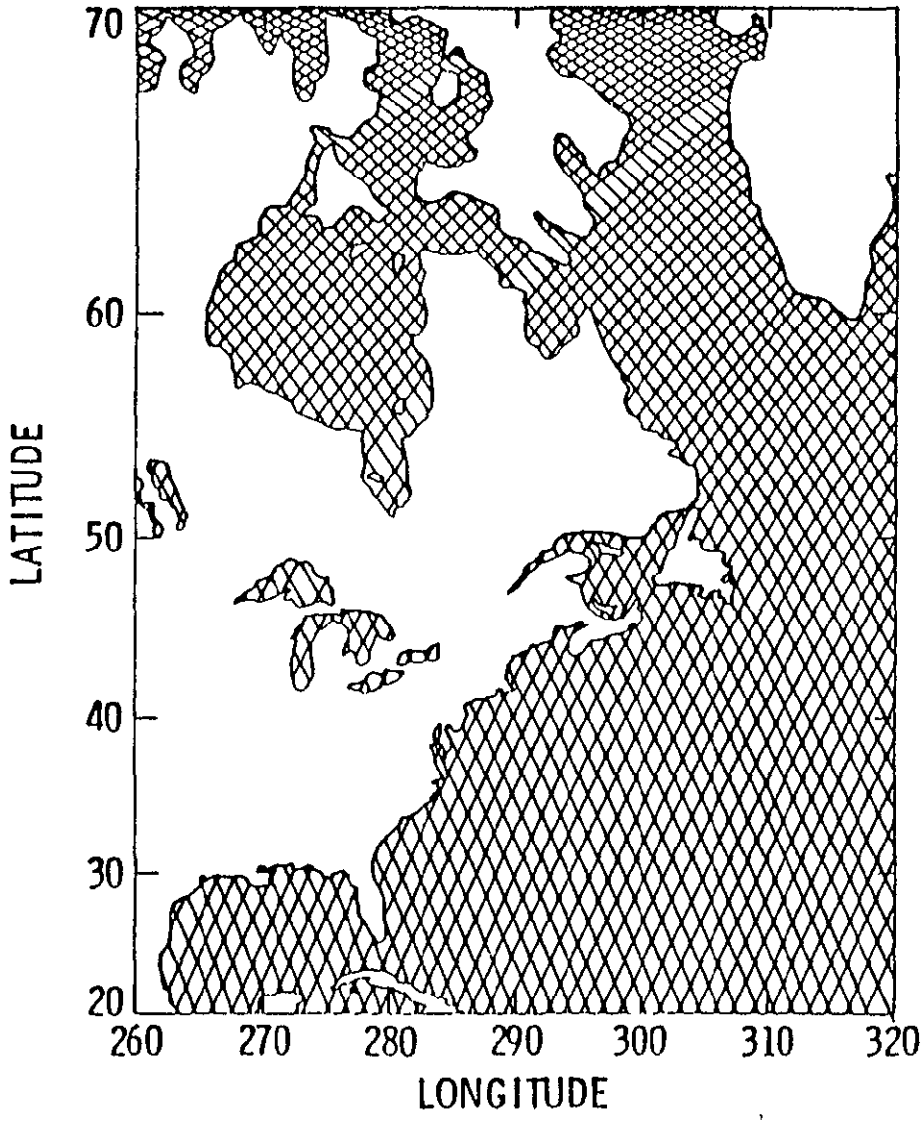


FIGURE 17 SEASAT-A LAUNCH ORBIT - 17 DAY COVERAGE

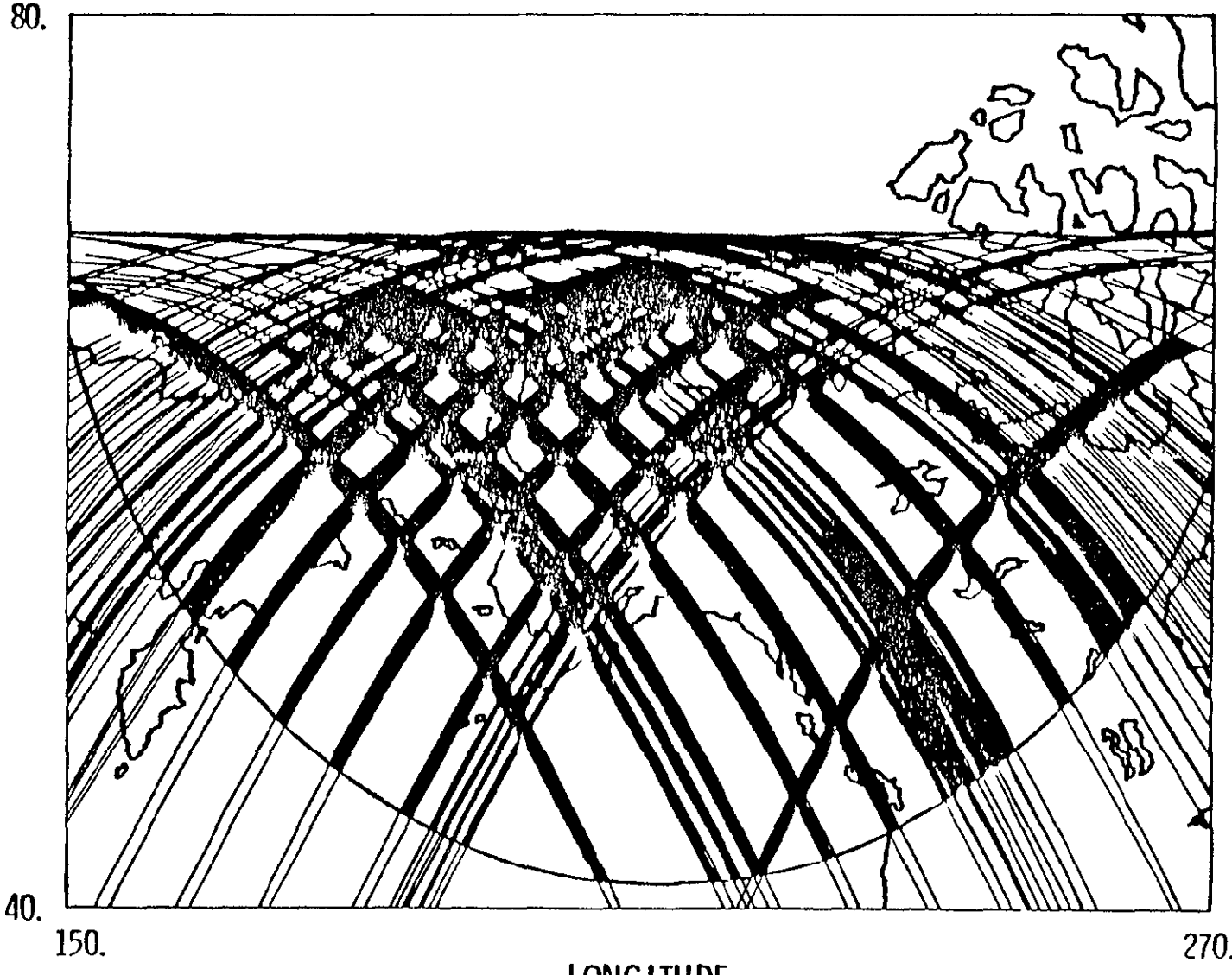


FIGURE 18 SAR - FAIRBANKS, ALASKA

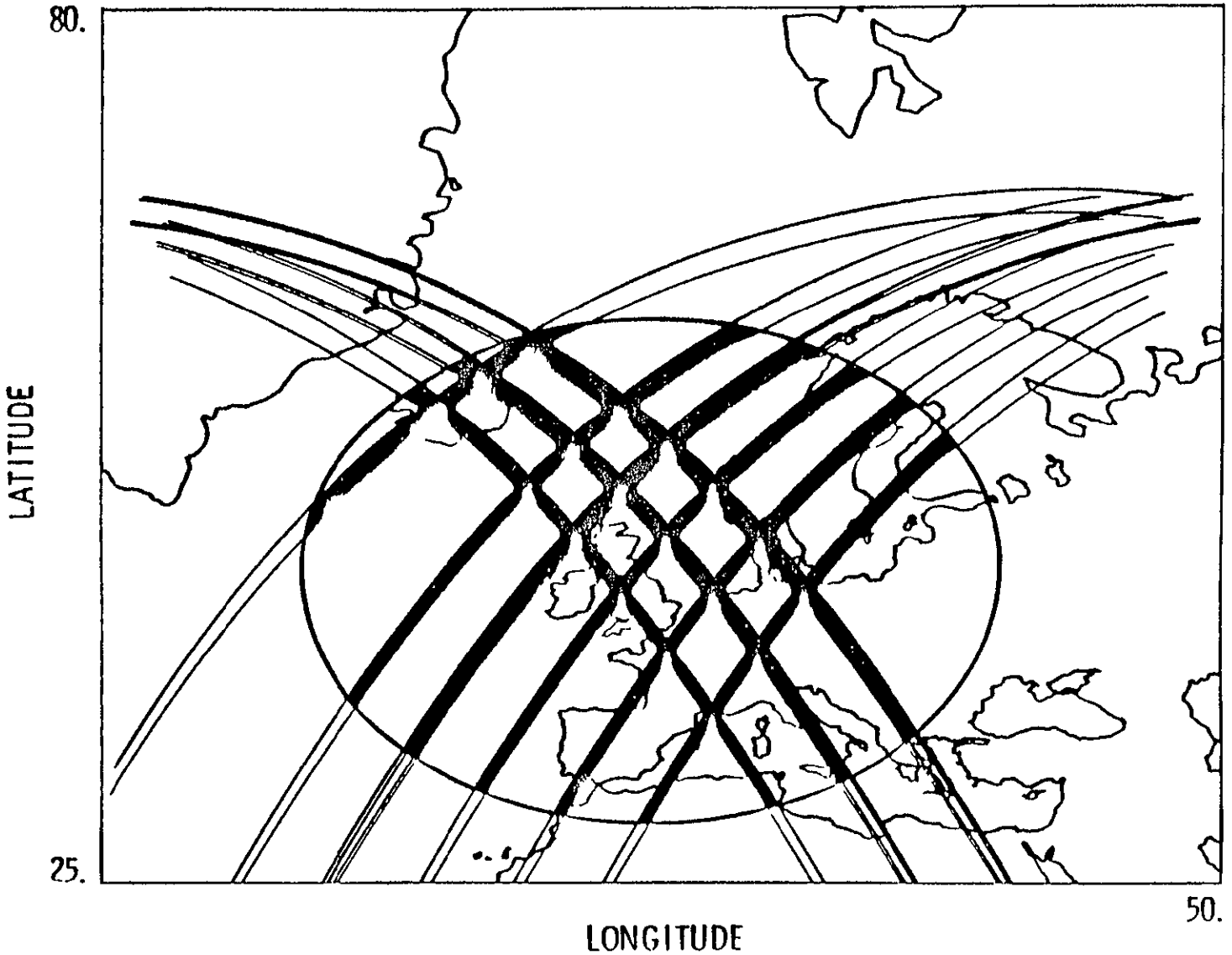


FIGURE 19 SAR - OAKHANGER, U.K. - AUGUST 28, 1978 - OCTOBER 10, 1978

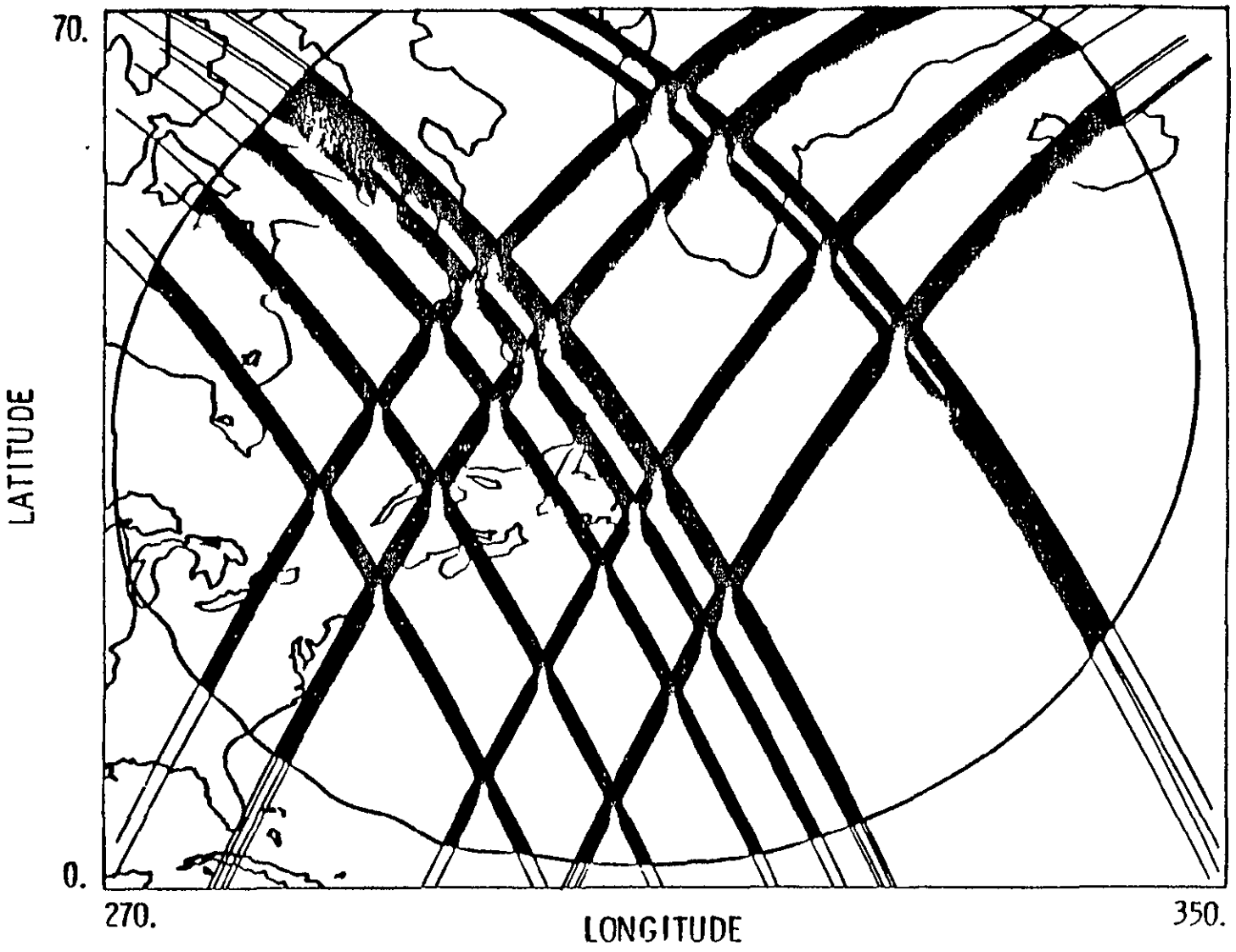


FIGURE 20 SAR - ST. JOHN'S, NEWFOUNDLAND - AUGUST 21, 1978 TO OCTOBER 10, 1978

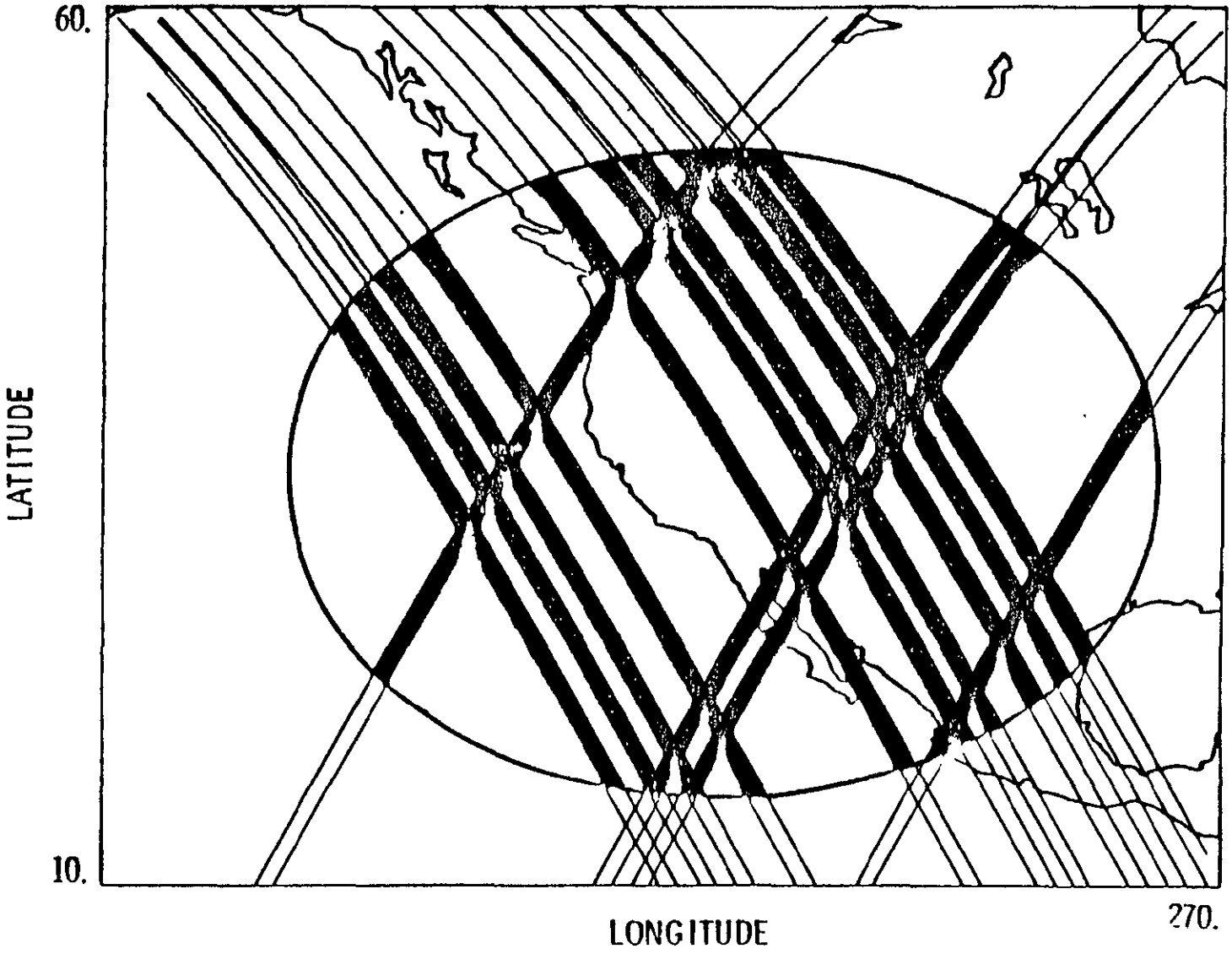


FIGURE 21 SAR - GOLDSTONE, CALIFORNIA - AUGUST 15, 1978 TO AUGUST 23, 1978

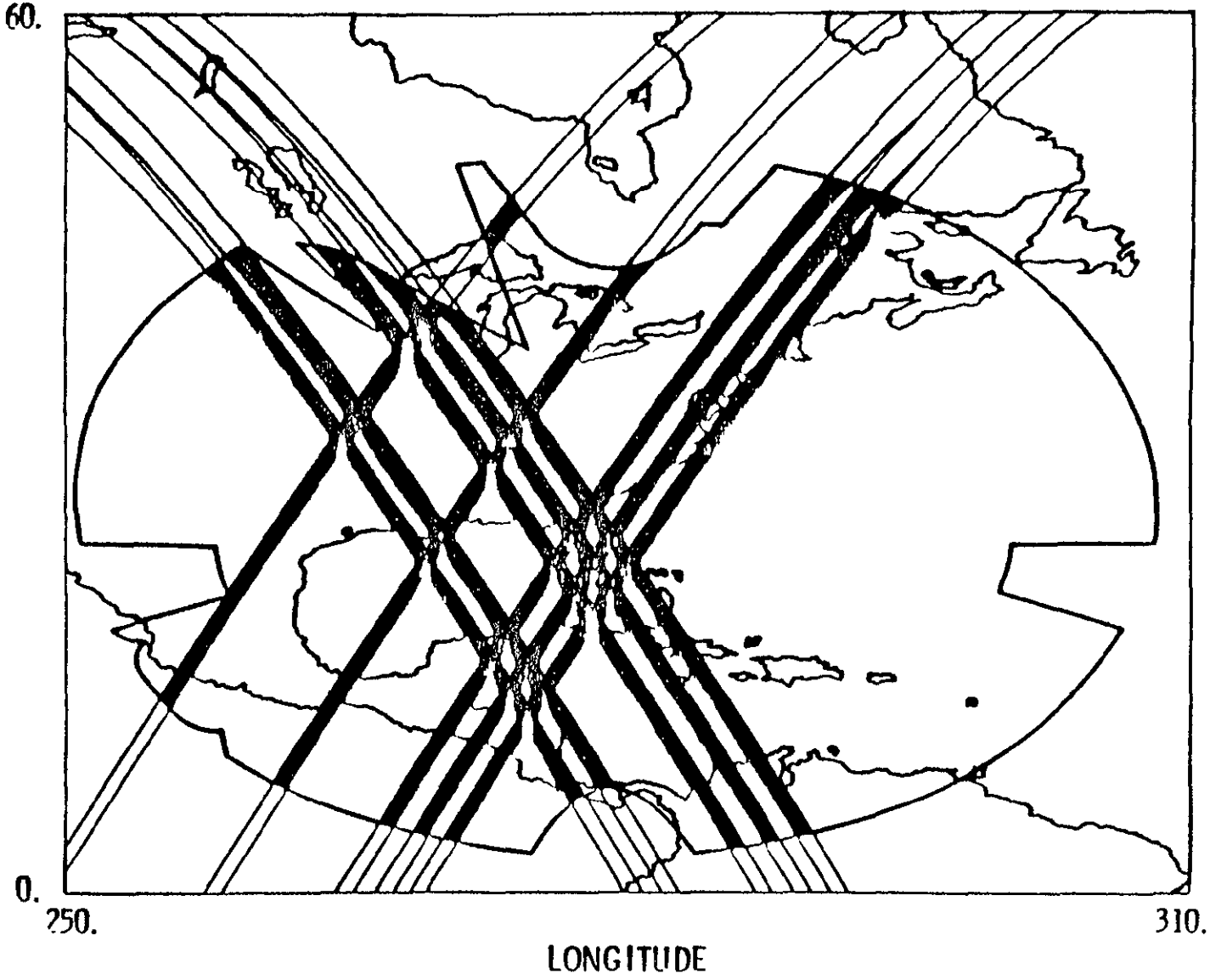


FIGURE 22 SAR - MERRITT ISLAND, FLORIDA - AUGUST 19, 1978 TO AUGUST 25, 1978

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4. PLANS FOR PROCESSING THE EXISTING SEASAT-A DATA SET

Dr. Dunne of JPL presented a discussion of the JPL data processing schedule reviewing again the project's objectives, techniques of the data analysis process and the functional data flow of the processed data to the users. The plan estimated that the entire data set evaluation could be completed, with GDRs available by the end of 1979. Dr. Wolff of Ocean Data Systems, Inc. commented that the data set would be of diminished value the longer the delivery to the users was delayed by development and evaluation of the algorithms.

The SAR data team estimates that approximately 10 percent of the obtained data will be converted into computer compatible tapes. The users expressed the desire to receive all the available SEASAT-A data as soon as possible.

Dr. Wolff of Ocean Data Systems, Inc. raised the question of building another SEASAT-A satellite. As it appears that this is unlikely to occur in the near future, Dr. Wolff emphasized the need to put all the available SEASAT-A data in GDRs and make the data available to the experimenters as soon as possible. With the failure of SEASAT-A after only 106 days of operation, it is probably not possible to evaluate the impact of SEASAT-A data on forecasts; however, Dr. Wolff urged that the data set be given the widest dissemination within the industrial and scientific communities at the earliest possible date.

Mr. Spedding of Esso Resources Canada agreed with Dr. Wolff's comments and emphasized that it would be totally unsatisfactory to have to wait until 1985 or 1990 for another satellite. The existing SEASAT-A data and the user data distribution can and should be evaluated with respect to their utility. The need for real-time ocean and weather data was mentioned by several of the experimenters

thus reiterating the desire of the experimenters to get the FNWC products, including the NIMBUS and GOES data, as available using the UDDS for data distribution. The 200-mile grid currently used by FNWC was not satisfactory to the coastal fisheries experimenters. Commander Honhart mentioned that FNWC is currently working in finer grid products which might possibly be made available to the experimenters.

5. THE USER DATA DISTRIBUTION SYSTEM

Mr. Poulson of JPL discussed the User Data Distribution System (UDDS) as it currently exists and plans for its future. The data distribution system has been installed and is partially operational at FNWC. Interface with the distribution network remains to be completed and the UDDS could be operational by January 1979.

Commander David Honhart, USN, from Fleet Numerical Weather Central then presented a discussion of the role which FNWC has and will continue to have with the SEASAT-A program. FNWC provides a real-time weather and oceanographic products analysis which is up-dated every 72 hours. The forecast models which are utilized improve as more data are input into algorithms, thus FNWC is interested in evaluating the impact of larger quantities and various types of data on the models.

FNWC is currently evaluating the software and hardware changes required to input NIMBUS-G and GEOS data into the standard FNWC products and distribute these products to the experimenters through the UDDS.

FNWC will also receive the set of PMDF tapes from Goddard Space Flight Center in order to calculate and validate the SDRs of the existing SEASAT-A data set. Hindcast analysis could then be done for the PMDF tapes that have been preprocessed. GOES data is already available at FNWC and can be incorporated directly into FNWC algorithms. Altimetric data could be made available to the experimenters as the existing algorithm for the altimeter GDRs appears adequate.

6. USER DATA REQUIREMENTS

During the meeting, the industrial users reexamined their original experiment data requirements in light of the current status of the SEASAT-A program. The following tables summarize the revised data requirements for the experiments.

TABLE 3 SEASAT-A MODIFIED USER REQUIREMENT - GDRs

	Experiment	Organization	Coverage Lat	Coverage Long	Time Period From	Time Period To	Days	Form
1	Beaufort Sea, oil, gas and Arctic Operation	Esso Resources, Canada	60°-65°N	Cst - 55°W	10/01	10/05	9	Tape
			Cst-56°N	126°-140°W	9/01	9/30	30	Tape
		Home Petroleum	69°-73°N	125°-140°W	TBS		TBS	Tape + Printout
		Gulf Canada Limited	Cst-72°N	125°-140°W	7/01	10/10	99	Printout + Graphics
2	Labrador Sea Oil, Gas and Sea Ice	Total Eastern Exploration	54°-60°N	60°- 63°W	7/01	10/10	99	Printout + Graphics
4.	U.S East Coast Offshore Oil and Gas	Continental Oil Company	37°-40°N	70°- 73°W	7/01	10/10	99	Tape
5	Worldwide Offshore Drilling and Production Operation	Getty Oil Co	14°-16°S	124°-126°E	7/01	10/10	95	Graphic
			12°N-7°S	25°E-30°W	7/01	10/10	99	Graphic
6	East Pacific Ocean Mining	Deepsea Ventures	5°-20°	110°-150°W	7/01	10/10	99	Printout or
			20°-40°N	Cst -150°W	7/01	10/10	99	Graphics
		Kennecott Exploration Inc	5°-20°	110°-150°W	7/01	10/10	99	Printout + Graphics
8	North Sea Oil and Gas	Union Oil Co.	61°N	2°E	7/01	10/10	99	Tape
			58°N	1°E	7/01	10/10	99	Tape
			60°N	2°E	7/01	10/10	99	Tape
			60°N	3°W	7/01	10/10	99	Tape
9.	Marine Environmental Forecasting in the North Sea	Oceanroutes, Inc.	45°-70°N	15°W-15°E	TBS		TBS	Binary Tape
16	Optimum Ship Routing		TBS		TBS		TBS	Binary Tape
10	Ocean Thermal Energy Conversion	Ocean Data Systems	15°-25°N	151°-162°W	7/01	10/10	99	Tape
			15°-22°N	70°- 75°W	7/01	10/10	99	Tape
			12°-30°N	80°- 95°W	7/01	10/10	99	Tape
			20°N-70°S	78°-135°E	7/01	10/10	99	Tape
			0°-10°N	19°W to Af. Coast	7/01	10/10	99	Tape
			0°-10°S	45°E to Af. Coast	7/01	10/10	99	Tape
			17°-25°N	117°to N A Coast	7/01	10/10	99	Tape
12	Ship Navigation and Simulation	Sun Shipbuilding and Dry Dock Co.	38°-52°N	306°-324°W	7/01	10/10	99	Tape or Printout
13	Int Ice Patrol N Survey							
14	Int Ice Patrol Drift Analysis	U.S Coast Guard	43°-46°N	46°- 50°W	8/15	8/30	17	77 Tape + Graphics
15	Int Ice Patrol Env Data							
19	Tropical and Temperate Tuna Fisheries	National Marine Fisheries Service	55°N-10°S	Cst -155°W	7/01	10/10	99	TBS
20	Pacific Salmon Fishery	Marine Advisory Service	34°-50°N	Cst -135°W	TBS		TBS	TBS
22	Improved Real-Time Weather Forecasting	Atmospheric Environmental Service	45°-60°N	125°-155°W				
			60°-75°N	115°-142°W	TBS		TBS	Tape or Printou
			20°-65°N	30°- 67°W				

Cst • Coast

Af • African

N A • North American

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TABLE 4 SEASAT-A NONREAL-TIME USER DATA REQUIREMENTS - SAR

Experiment	Organization	Coverage Lat.	Coverage Long.	Time Period From	Time Period To
1. Beaufort Sea, Oil, Gas and Arctic Operation	ESSO Resources, Canada	45°-65°N	Cst - 50°W	7/01	10/10
		Cst-72°N	126°-140°W	7/01	10/10
	Dome Petroleum	69°-73°N	125°-140°W	TBS	
	Gulf Canada Limited	Cst-72°N	125°-140°W	7/01	10/10
2. Labrador Sea Oil, Gas and Sea Ice	Total Eastern Exploration	54°-60°N	60°- 65°W	7/01	10/10
4. U.S. East Coast Offshore Oil and Gas	Continental Oil Company	37°-40°N	70°- 73°W	TBS	
6. East Pacific Ocean Mining	Kennecott Exploration Inc.	5°-20°	110°-150°W	7/01	10/10
7. Bering Sea Ice Project	Oceanographic Services Inc.	54°-70°N	157°-175°W	TBS	
12. Ship Navigation and Simulation	Sun Shipbuilding and Dry Dock Co.	38°-52°N	306°-324°W	TBS	
13. Int. Ice Patrol - N. Survey	U.S. Coast Guard	50°-70°N	45°- 60°W	TBS	
14. Int. Ice Patrol - Drift Analysis					
15. Int. Ice Patrol - Env. Data					
19. Tropical and Temperate Tuna Fisheries	National Marine Fisheries Service	55°N-10°S	Cst -155°W	7/01	10/10
20. Pacific Salmon Fishery	Marine Advisory Service	34°-50°N	Cst -135°W	TBS	
22. Improved Real-Time Weather Forecasting	Atmospheric Environmental Service	45°-60°N 68°-75°N 20°-65°N	125°-155°W 115°-142°W 30°- 67°W	TBS	

Cst = Coast

TABLE 5 SPECIFIC HOURS OF TRANSMISSION

	Experiment	Transmission Frequency	Specific Hours
1.	Beaufort Sea, Oil, Gas, and Arctic Operation	TBS	TBS
2.	Labrador Sea, Oil, and Gas	Once/day	When available
4.	U.S. East Coast Offshore Oil and Gas	Four times/day	Six Hour Intervals Starting at 0600 GMT
5.	Worldwide Offshore Drilling and Production Operations	Once/day	Between 1400 and 2300 GMT
6.	East Pacific Ocean Mining	Once/day	About 0200 GMT
9.	Marine Environmental Forecasting in North Sea	Twice/day	0000 and 1200 GMT
10.	Ocean Thermal Energy	Two to Four times/day	When available
12.	Ship Navigation and Simulation	Once/day	1400 and 2200 GMT
15.	International Ice Patrol Environmental Data	Twice/day	0800 and 2000 GMT
16.	Optimum Ship Routing	Twice/day	0200 and 1400 GMT
19.	Tropical and Temperate Tuna Fisheries	Once/day	About 1800 GMT
20.	Pacific Salmon	Twice/day	Morning at 1400 and 1500 GMT and Evening at 0400-0600 GMT
22.	Improved Real-Time Weather Forecasting	TBS	TBS

TABLE 6 REAL-TIME INFORMATION SYSTEM DATA PRODUCT - SOURCE REQUIREMENTS

Experiment	Data Source
1. Beaufort Sea, Oil, Gas and Arctic Operation	NIMBUS G
2. Labrador Sea, Oil, Gas and Sea Ice	TBS
4. U.S. East Coast Off-shore Oil and Gas	FNWC
5. Worldwide Offshore Drilling and Production Operations	FNWC
6. East Pacific/Ocean Mining	GEOS NIMBUS G FNWC Combined
9. Marine Environmental Forecasting in North Sea 16. Optimum Ship Routing	FNWC
10. Ocean Thermal Energy Conversion	NIMBUS G FNWC Other Satellite
12. Ship Navigation and Simulation	TBS
13. 14. International Ice Patrol 15.	NIMBUS G FNWC
19. Tropical and Temperate Tuna Fisheries	NIMBUS G FNWC
20. Pacific Salmon	FNWC
22. Improved Real-Time Weather Forecasting	NIMBUS G GEOS

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TABLE 7 REAL-TIME INFORMATION SYSTEM DATA PRODUCT REQUIREM

Experiment	Nimbus G. Data Products
1. Beaufort Sea, Oil, Gas and Arctic Operations	1. Sea Surface Temperature 2. Wind Magnitude
	FNWC Data Products
2. Labrador Sea, Oil, Gas and Sea Ice	TBS
4. U.S. East Coast Off-Shore Oil and Gas	1. Marine Winds: Magnitude and ection (A, τ = 12, 24) 2. Sea Surface Temp. (A) 3. Atmospheric Pressure at sea el (A, τ = 12, 24) 4. Significant Wave Heights. (A, τ = 12, 24) 5. Primary Wave: Direction an eriod (A, τ = 12, 24) 6. Spectral Wave Data (A, τ = 24) 7. Air Temperature at sea lev (A) 8. FNWC Observations in tabul format
5. Worldwide Offshore and Production Operations	1. Marine Winds: Magnitude Direction. (A, τ = 24) 2. Sea Surface Temperature. A) 3. Atmospheric Pressure at level, 500, 700, and 850 mb. levels. A, τ = 24) 4. Significant Wave Heights (A, τ = 24) 5. Primary Wave: Direction d Period. (A, τ = 24) 6. Spectral Wave Data. (A = 24)
6. East Pacific Ocean Mining	1. Marine Winds: Magnitud and Direction (A, τ = 12, 24, 48, 72) 2. Significant Wave Heigh (A, τ = 12, 24, 48, 72) 3. Primary Wave: Directi and Period. (A, τ = 12, 24, 48, 72) 4. Atmospheric pressure sea level. (A, τ = 12, 24, 48, 72 5. Spectral Wave Data. A, τ = 12, 24, 48, 72) 6. FNWC Observations in abular format
9. Marine Environmental Forecasting in the North Sea	1. Marine Winds: Magnitude and Direction (A, τ = 12, 24, 48, 72) 2. Sea Surface Temperature (A) 3. Sea level pressure nd 500 mb constant pressure (A, τ = 12, 24, 48, 72) 4. Spectral Wave (A, τ = 12, 24, 48, 72)

TABLE 7 REAL-TIME INFORMATION SYSTEM DATA PRODUCT REQUIREMENTS (CONTINUED)

Experiment	FNWC Data Products
10. Ocean Thermal Energy Conversion	1. Marine Wind Magnitude and Direction (A). 2. Atmospheric Pressure at Sea Level (A, τ = 12, 24) 3. Sea Surface Temperature (A). 4. Spectral Wave Data (A).
12. Ship Navigation and Simulation	1. Marine Wind: Magnitude and Direction (A, τ = 12, 24, 48, 72) 2. Significant Wave Heights (A, τ = 12, 24, 48, 72) 3. Primary Wave: Direction and Period (A, τ = 12, 24, 48, 72) 4. Spectral Wave Data (A, τ = 12, 24, 48, 72)
15. International Ice Patrol Environmental Data	1. Marine Wind: Magnitude and Direction (A, τ = 12) 2. Sea Surface Temperature (A).
16. Optimum Ship Routing	1. Marine Wind: Magnitude and Direction (A, τ = 24, 48, 72) 2. Sea Surface Temperature (A). 3. Atmospheric Pressure at Sea Level (A, τ = 24, 48, 72) 4. Significant Wave Heights (A, τ = 24, 48, 72) 5. Primary Wave Direction (A, τ = 24, 48, 72) 6. Primary Wave Period (A, τ = 24, 48, 72)
19. Tropical and Temperate Tuna Fisheries	*1. Marine Wind: Magnitude and Direction (A, τ = 12) 2. Sea Surface Temp. (A) 3. Significant Wave Height (A, τ = 12) 4. Primary Wave Direction. (A)
20. Pacific Salmon	1. Marine Wind: Magnitude and Direction (τ = 12) 2. Sea surface Temperature (A, τ = 24) 3. Atmospheric pressure at sea level (τ = 12)

* Desire daily forecast from analysis having maximum observations

A. Analysis Product (nowcast)

τ = 12: Forecast Product at 12 hours after nowcast

TABLE 8 REAL-TIME USER FORMAT REQUIREMENTS

Experiment	Data Product Format
1. Beaufort Sea, Oil, Gas and Arctic Operation	Tabular
2. Labrador Sea, Oil, Gas and Sea Ice	TBS
4. U.S. East Coast Off-shore Oil and Gas	1. Graphics with: a. Isopleths b. Coordinates c. Sea-level pressure and marine winds plotted together. 2. Standard FNWC Contour Intervals 3. Mercator map projection 4. Analysis and forecast products in tabular format
5. Worldwide Offshore Drilling and Production Operations	1. Graphics with: a. Isopleths b. Coordinates c. Sea-level pressure and marine winds plotted together. 2. Standard FNWC Contour Intervals 3. Mercator and Polar Stereographic Map Projections depending on the latitude of sub-region 4. Analysis and forecast products in tabular format
6. East Pacific/Ocean Mining	1. Graphics with: a. Isopleths b. Coordinates c. Sea-level pressure and marine winds plotted together. 2. Standard FNWC Contour Intervals 3. Mercator Map Projection
9. Marine Environmental Forecasting in North Sea	1. Graphics with: a. Isopleths b. Coordinates c. Landmasses d. Sea-level pressure and marine winds plotted together. e. Sea surface temperature and marine winds from analysis plotted together. 2. Contour Intervals Pressure: 4 mb SST: 2^{o} C Wave Heights: 1 meter 3. Expanded polar stereographic projection.

TABLE 8 REAL-TIME USER FORMAT REQUIREMENTS (CONTINUED)

Experiment	Data Product Format
10. Ocean Thermal Energy	1. Analysis and forecast products in tabular format
12. Ship Navigation and Simulation	1. Analysis and forecast products in tabular format
15. International Ice Patrol Environmental Data	1. Graphics (for SST only) with: a. Isopleths b. Coordinaters c. Landmasses 2. Standard FNWC Contour Interval 3. Mercator Map Projection 4. Tabular format for Marine Wind computed at 1° latitude and 2° longitude samples.
16. Optimum Ship Routing	1. Graphics with: a. Isopleths b. Coordinates c. Landmasses d. Sea-level pressure and marine winds plotted together. 2. Contour Intervals: Pressure: 4 mb SST: 2°C Wave Heights: 1 meter 3. Mercator Map Projection
19. Tropical and Temperate Tuna Fisheries	1. Graphics with: a. Isopleths b. Coordinates c. Landmasses 2. Contour Intervals: SST: 1°F Marine Winds: 10°-20° Marine Wind Magnitude: 5 kts Significant Wave Height: 3 ft 3. Mercator map projection
20. Pacific Salmon	1. Graphics with: a. Isopleths b. Coordinates c. Landmasses d. Sea-level pressure and marine winds plotted together. 2. Contour Intervals: SST: 1°F Wind Direction: 20° Wind Magnitude: Finest Atmospheric Pressure: Scale 3. Mercator Map Projection

7. INDUSTRY SURFACE TRUTH PROGRAM

The meeting was then opened to the industrial experimenters to describe the sea surface truth data which they had collected during the operation of SEASAT-A. In general, the users described the data collection sites, facilities, time period and data types which were recorded as a part of the SEASAT-A Sea Surface Truth Program.

Mr. Siapno from Deep Sea Ventures began the discussion with the details of the mid-Pacific ocean mining surface truth program. The area of operation of the two drill ships collecting data during the operation of the satellite was 15N, 125W. Mining operations were stopped from mid-June through mid-October because of hurricane season, thus surface truth was not collected during this period.

The Ocean Mining Experiment, in general, is concerned with the analysis of SEASAT-A data in the Northeast Pacific in terms of tropical depressions, tropical storms and hurricanes. Mr. Siapno summarized his interest in the data as five major points:

- Genesis (when first defined)
- Growth (plus or minus)
- Movement (rate of development)
- Location (coverage, intensity, radius)
- Related Factors.

An objective of his proposed experiment was to evaluate the predictions made with SEASAT-A with the actual storm occurrence.

The on-site surface truth data collected by Deepsea Ventures recorded atmospheric and sea surface conditions on-station in the mid-Pacific, as well as to

and from the port(s). The following outlines the data types and instrumentation involved in the ocean mining surface truth operation:

On-Site - Ground Truth Data - Sequenced to SEASAT Schedule

Atmosphere:

- Temperature
- Precipitation
- Wind Speed and Direction
- Visibility
- Barometric Pressure
- Cloud Cover (Type & Ceilings)

Sea Surface:

- Temperature
- Current Direction
- Wave (Direction, Height, Length, Period)
- Swell (Direction, Height, Length, Period)

Instrumentation:

- Anemometers
- Radar
- Thermometers
- Wave Riders
- Barometers

Mr. Spedding, of Esso Resources Canada, then described the test sites and data collection by Esso Resources Canada and Total-Eastcan Exploration in the Labrador and Beaufort Seas during July through September 1978. Tables 9 and 10 and Figures 23 and 24 outline the sites, collected data and times of operation.

TABLE 9 GROUND TRUTH MEASUREMENTS AVAILABLE FOR EAST COAST - JULY TO OCTOBER 1979 - LABRADOR SEA

ESSO RESOURCES

Meteorological Data Available

TWO SHIPS' CRUISES
JULY 28 - AUGUST 31ST AS FAR NORTH AS 66°30'
AUGUST 6TH - AUGUST 27TH AS FAR NORTH AS 68°

Land Stations (Data Transmission via Nimbus)

BREVOORT ISLAND SEPTEMBER 15TH
RESOLUTION ISLAND SEPTEMBER 15TH

10 Metre Discus Buoy

DEPLOYED 78 10 04 2100 HRS.
LOCATION 61°40°N 60°35'W 3000'WD
GOES LINK TO SUITLAND, MARYLAND
H.F. LINK TO FLATROCK, ST. JOHN'S

Wind Speed & Direction (2)

BAROMETRIC PRESSURE
AIR AND SEA TEMP.
WAVE DATA

Sea Ice

NO SEA ICE ENCOUNTERED ON CRUISES
SOME ICEBERG OBSERVATIONS

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TOTAL - EASTCAN EXPLORATION

Meteorological Data Available

3 HR. WIND SPEED & DIRECTION
BAROMETRIC PRESSURE
AIR TEMPERATURE, DEWPOINT ETC.

Seastate

WAVE HEIGHTS FROM WAVERIDER BOUY

Iceberg Observations

ANY ICEBERGS WITHIN 30 KM OF SHIP

Information from Drillship

LOCATED LAT. 58°26'N LONG. 61'45'
FROM JULY 22ND - SEPTEMBER 29TH

LOCATED LAT. 54°51'N LONG. 55'44W
FROM OCTOBER 2ND - STILL DRILLING

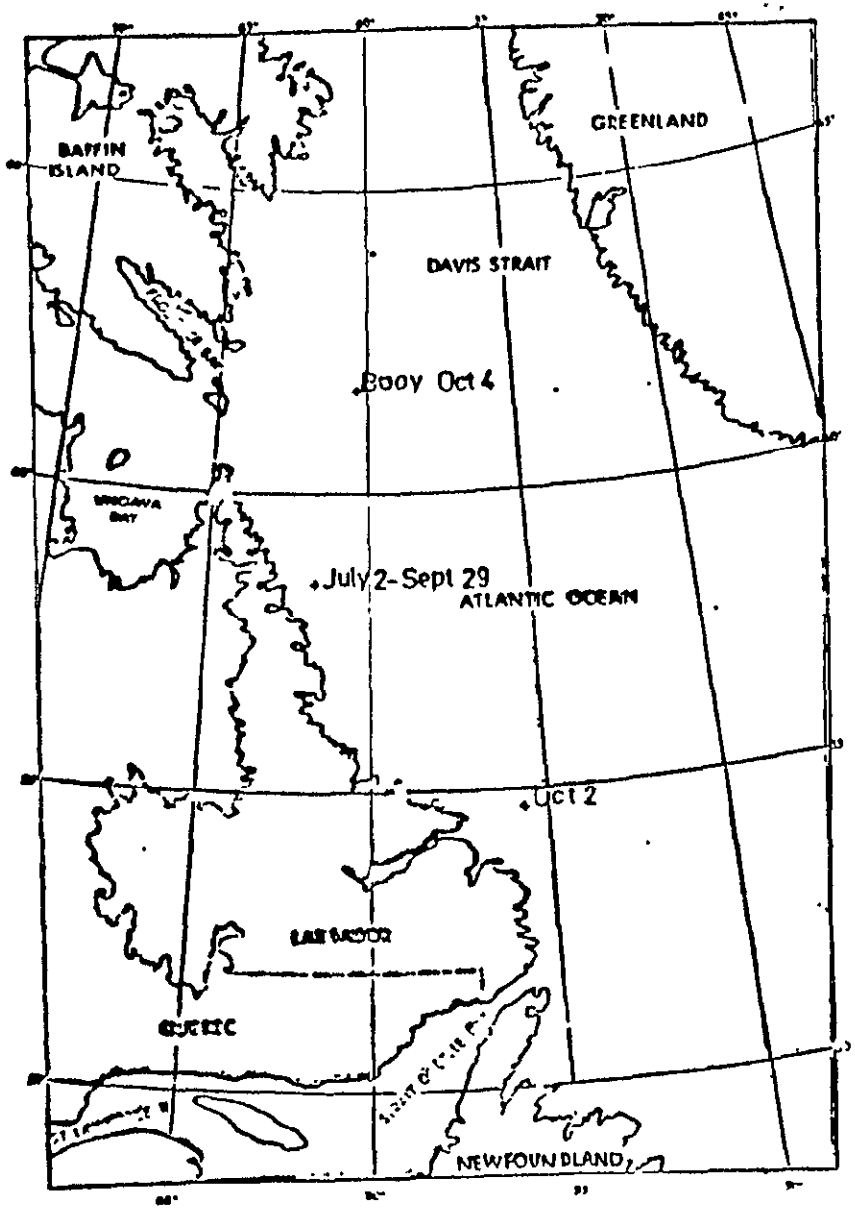

FIGURE 23 MAP - LABRADOR SEA

TABLE 10 GROUND TRUTH MEASUREMENTS AVAILABLE FOR PERIOD JULY 1 TO OCTOBER 9, 1978 - BEAUFORT SEA

ESSO RESOURCES

Meteorological Parameters

3 hourly wind speed & direction
altimeter
barometric pressure
cloud cover and visibility
air temperature

Seastate Parameters

wave heights
water temperature
ice conditions

Information Collected at these Locations

1) beaver mackenzie at issunignak O-61 (70°01',134°19'1")
2) camp 17 pullen island 69°47' 134°18'
3) camp 208 tuft point 69°40' 132°50'

Data Available for Period

1) july 29 - oct 5
2) aug 1 - sept 15
3) july 15 - sept 28

N.O.A.A. and Landsat imagery available for summer.
Canadian and fleet weather ice charts
Ice observations around issunignak for July 26 - Aug 5
Some ice returned the end of August

DOME PETROLEUM/CANMAR

Meteorological Parameters

1 hourly wind speed & direction
air temperature, dewpoint
barometric pressure
cloud cover, type, ceiling

Seastate Parameters

wave heights and periods
water temperature
turbidity and salinity (daily)
ice conditions from daily recce flights
ice conditions and drift velocities around ships

Information Collected at these Locations

KAGLULIK	A-75	JULY 8 - AUG 6
TARSUIT	A-25	AUG 19 - SEPT 1
NATSEK	E-56	JULY 8-25 & SEPT 3-OCT
KOPANOAR	M-13	JULY 26 - OCT 9
UKALERK	C-50	JULY 8 - OCT 9
NERLAK	M-98	AUG 7 - AUG 17

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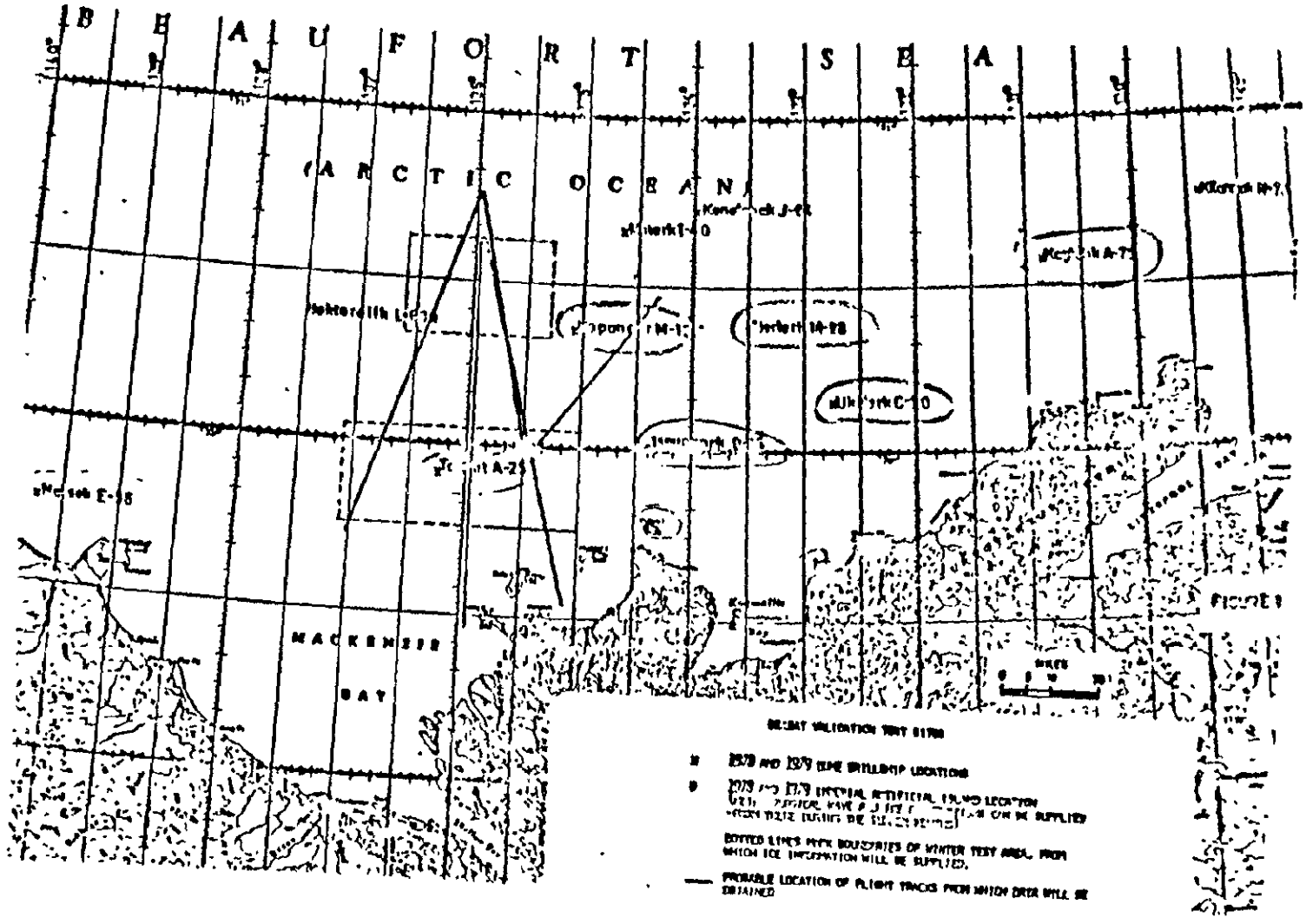

FIGURE 24 MAP - BEAUFORT SEA

Mr. Newton, of Getty, discussed the data collected on the "Discoverer Seven Seas" drillship during July to October 1978 (Table 10). Dr. Laurs of the National Marine Fisheries Service then provided the data collecting cruise patterns for two scientific vessels, the "David Starr Jordan" and the "Alejandro de Humboldt" during June and July 1978 (Tables 11 through 13 and Figures 25 through 28).

Mr. Utt, representing Union Oil, continued with the discussion of the joint Union/Conoco platform in the North Sea. Data from this particular site is unavailable; however, data from the United Kingdom Offshore Operators Association (UKOOA) is available from these sites shown in Figure 29 and Table 14.

TABLE 11 GETTY OIL COMPANY ENVIRONMENTAL DATA MEASURED ON THE "DISCOVERER SEVEN SEAS" DRILLSHIP DURING JULY TO OCTOBER 1978

1. JULY 1 TO JULY 23, 1978

LOCATION: IBIZA MARINO, SPAIN

APPROXIMATE COORDINATES: 39°N, 1°E

2. JULY 24 - AUGUST 2, 1978

VESSEL UNDERWAY. NO MEASUREMENTS TAKEN.

3. AUGUST 3 - OCTOBER 1, 1978

LOCATION: STRAIGHT OF ONTRANTO, ITALY

APPROXIMATE COORDINATES: 37°N, 15°E

MEASURED ENVIRONMENTAL PARAMETERS

ENVIRONMENTAL DATA WAS MEASURED AND RECORDED ON MAGNETIC TAPES FROM THE HONLYWELL "ASK" SYSTEM. THE FOLLOWING DATA WAS RECORDED AT 1-SECOND INCREMENTS:

- DAY AND TIME
- WIND VELOCITY AND DIRECTION
- WAVE ELEVATION

TABLE 12 CRUISE ANNOUNCEMENT - NATIONAL MARINE FISHERIES SERVICE - "DAVID STARR JORDAN"

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
Southwest Fisheries Center
La Jolla, California 92038

CRUISE ANNOUNCEMENT

VESSELS: David Starr Jordan, Cruise No. 7807 DS78-05 (118)
Alejandro de Humboldt, Cruise No. 7807

CRUISE DATES: Jordan: June 20 - July 19, 1978 (data collecting over cruise pattern)
Humboldt: June 20 - July 11, 1978 (data collecting over cruise pattern)

ITINERARY: Jordan:

Starting at CalCOFI line 93, Jordan will occupy lines 93 through 60 (see attached pattern). A brief stop will be made to exchange personnel at either Long Beach or Port Hueneme. After completion of station 93.35, two SIO personnel will be put ashore at San Clemente Island to install a Tide Gage.

Humboldt:

Starting at CalCOFI line 97, Humboldt will occupy lines 97 through 137 (see attached pattern).

OBJECTIVES: 1. Collect biological samples in a continuing program of studying the ecology of the California Current.

2. Collect data with which to describe the physical and chemical oceanographic features associated with changes in the number and availability of commercially important fishes.

EQUIPMENT:
1. CalCOFI Bongo nets
2. CalCOFI 1-meter nets
3. Phyto nets
4. Manta nets
5. Nansen bottles and thermometers
6. Salinometer
7. Auto-analyzer
8. Drift bottles
9. Coulter counter (Jordan only)
10. Plankton pump and fluorometer (Jordan only)
11. XBT's and launcher (Jordan only)
12. CTDO (Jordan only)
13. Secchi Disk

TABLE 13 CRUISE REPORT - NATIONAL MARINE FISHERIES SERVICE - "DAVID STARR JORDAN"

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANICA AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
Southwest Fisheries Center
La Jolla, California 92038

CRUISE REPORT

VESSEL: David Starr Jordan, Cruise No. 7808-JD, DS78-06(119) LEG A

CRUISE DATES: July 31 - August 30, 1978

ITINERARY:
Leave San Diego, 1330 PST, July 31, 1978
Arrive Long Beach, 1100 PST, August 10, 1978
Leave Long Beach, 1800 PST, August 10, 1978
Arrive Santa Barbara, 1140 PST, August 15, 1978
Leave Santa Barbara, 1825 PST, August 15, 1978
Arrive Monterey, 1845 PST, August 21, 1978
Leave Monterey, 0600 PST, August 23, 1978
Arrive San Diego, 0400 PST, August 30, 1978

Stations deleted:

93.170, .190, .200
90.170, .190, .200
90.45 (replaced by 89.7 41.5 due to Naval torpedo practice)
77.48 (radars inoperative)
67.80
63.80

Trawling for anchovy done by P. Smith and R. Methot at points near Pt. Vicente, Sta. 83.40, Santa Barbara, Pt. Conception, Sta. 67.70, S.L.O. Bay, Santa Cruz Island, Oceanside, Del Mar and Pt. Loma.

OBJECTIVES:
1. To collect biological samples in a continuing program of studying the ecology of the California current.

2. To collect data with which to describe the physical and chemical oceanographic features associated with changes in the number and availability of commercially important fishes.

WORK COMPLETED:
118 stations occupied
117 CalCOFI oblique bongo tows (300 meters wire out, depth permitting)
80 Manta surface tows
41 Phyto tows (vertical, 100 m.w.o., depth permitting)
16 1-meter CalCOFI oblique net tows (300 m.w.o., depth permitting)
15 special Theilacker tows (40 m.w.o.)
98 CTD/O casts
86 Hydro casts (18 bottles to 500 m, depth permitting)

TABLE 13 CRUISE REPORT - NATIONAL MARINE FISHERIES SERVICE - "DAVID STARR JORDAN" (CONTINUED)

31 10 m bottles (including some CTD/O calib. bottles)
68 drift bottle stations (12 bottles per station)
20 XBT drops
32 pumps for chlorophyll maximum layer
28 Tritium casts (147 samples)
191 CTD/O calibration bottles
46 Secchi disc observations
40 6' Isaacs-Kidd midwater trawls

- Weather observations at all stations
- Oxygen, chlorophyll, nutrient and salinity samples were collected and processed for each designated station
- Continuous recording of surface temperature and salinity over the entire track by thermosalinograph
- Daylight watch maintained for marine mammals.

EQUIPMENT MALFUNCTIONS/ LOSS:
1. One Nansen bottle lost from wire.
2. Reversing thermometers with faulty mercury breaks.
3. Defective flow meter.
4. XBT chart drive malfunction.

SCIENTIFIC PERSONNEL:
C. Sanchez, NMFS, Cruise Leader
H. Hogan, NMFS, (Aug. 10-30)
A. Majors, NMFS (July 31 - Aug. 10)
P. Smith, NMFS
R. Wolf, NMFS (July 31 - Aug. 10)
J. Baumert, Univ of Washington
C. Young, Univ. of Washington
D. Bos, GOG/SIO
W. Bryan, DCPG/SIO
M. Costello, DCPG/SIO
H. Fastenau, DCPG/SIO
V. Lehmann, DCPG/SIO
R. Methot, MLRG/SIO

Date: 7 Sept 78 Prepared by Carol A. Sanchez
Carol Sanchez, Cruise Leader

Approved by John F. Carr
for Izadore Barrett, Center Director

TABLE 14 UKOOA DATA

STATION	TIME LAG	WAVE HT	WIND SPEED & DIRECTION	AIR & WATER TEMPS.
BRENT PLATFORM	6 MOS.	20 MIN./3 HR.	10 MIN./HR.	45 SEC./HR.
FORTIES PLATFORM	8 MOS.	20 MIN./3 HR.	10 MIN./HR.	30 SEC./HR.
FRIGG PLATFORM	— ? —	20 MIN./3 HR.	10 MIN./HR.	30 SEC./HR.
FOULA BOUY	6 MOS.	20 MIN./3 HR.	10 MIN./HR.	30 SEC./HR.

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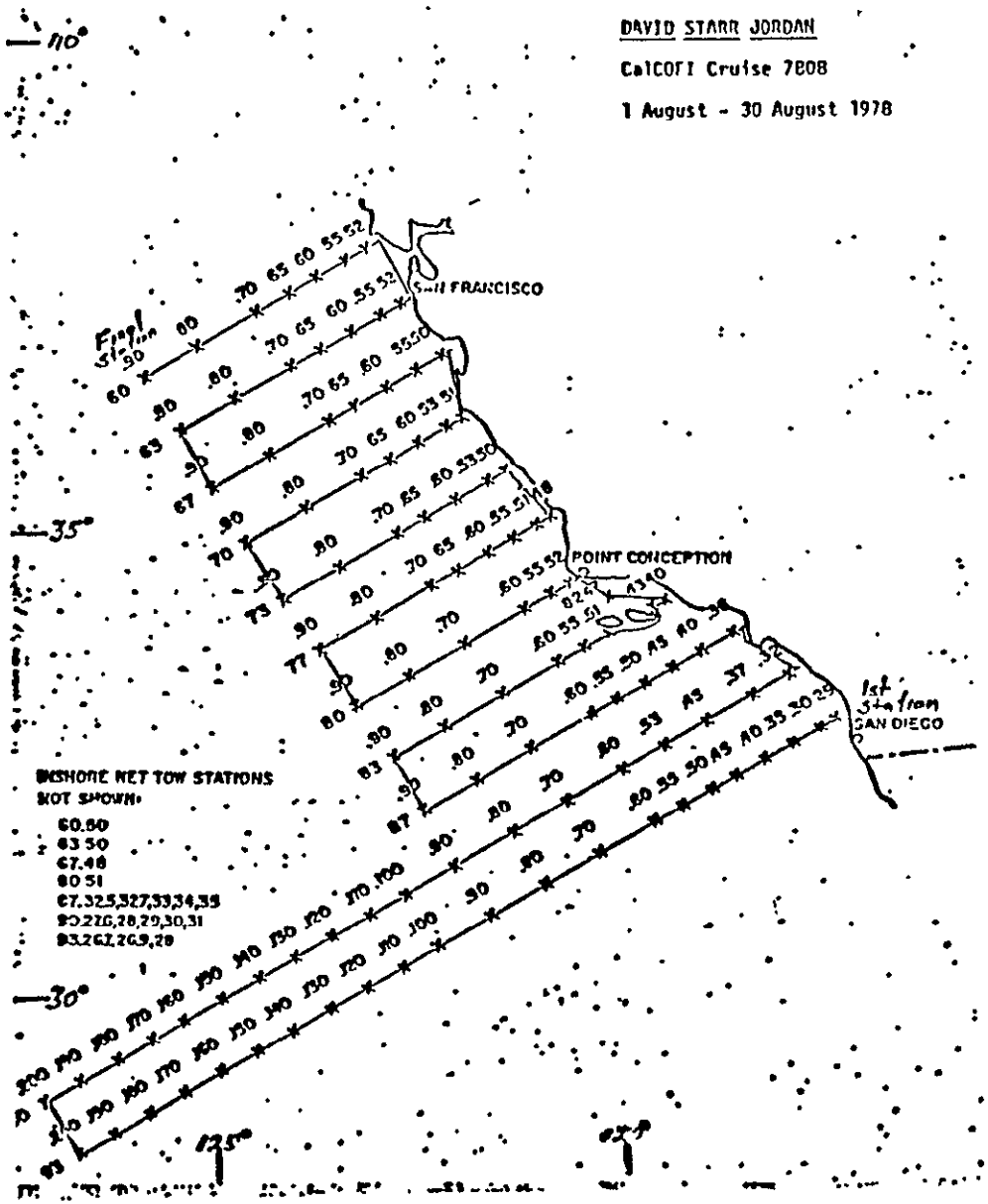

FIGURE 25 MAP - "DAVID STARR JORDAN" CRUISE - 1 AUGUST TO 30 AUGUST 1978

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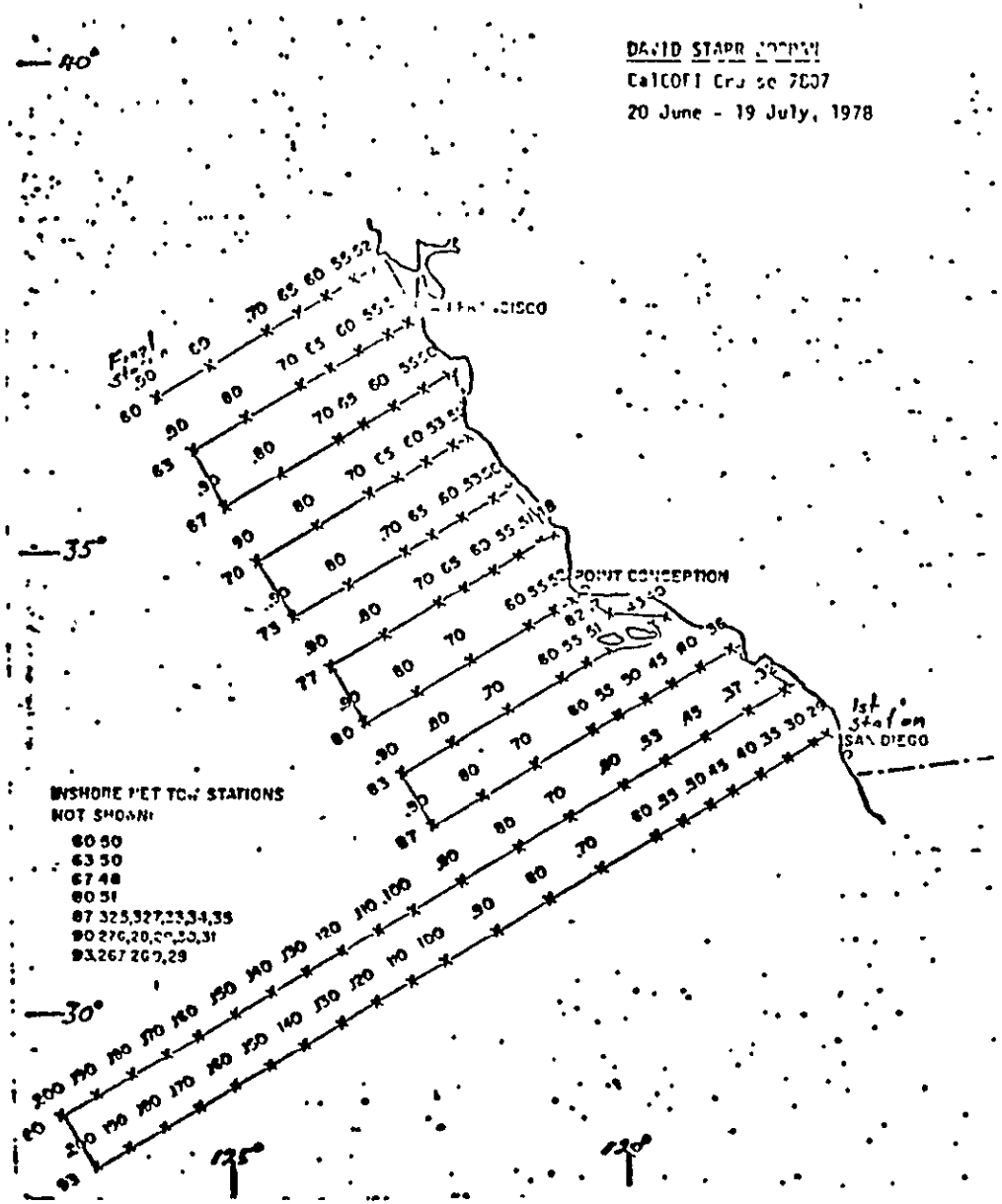

FIGURE 26 MAP - "DAVID STARR JORDAN" CRUISE - 20 JUNE TO 19 JULY 1978

ALEJANDRO DE HUMBOLDT

CalCOFI Cruise 7808

31 July - 28 August 1978

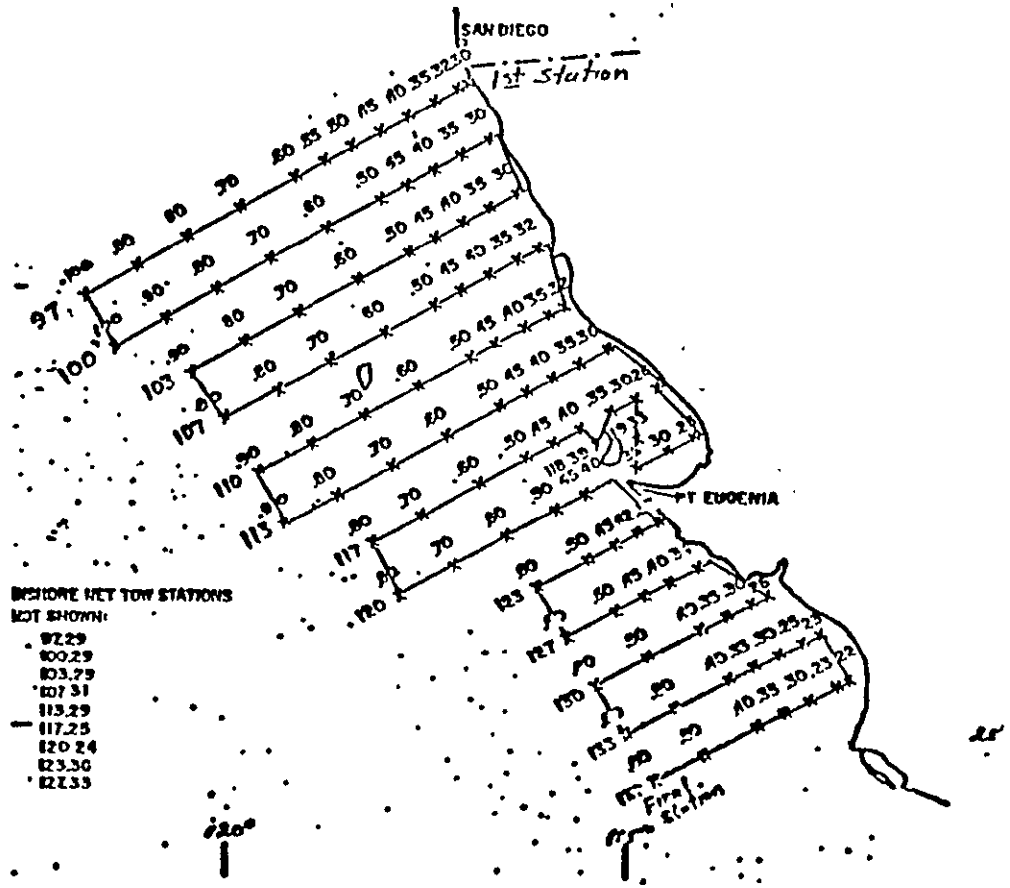

FIGURE 27 MAP - "ALEJANDRO DE HUMBOLDT" CRUISE - 31 JULY TO 28 AUGUST 1978

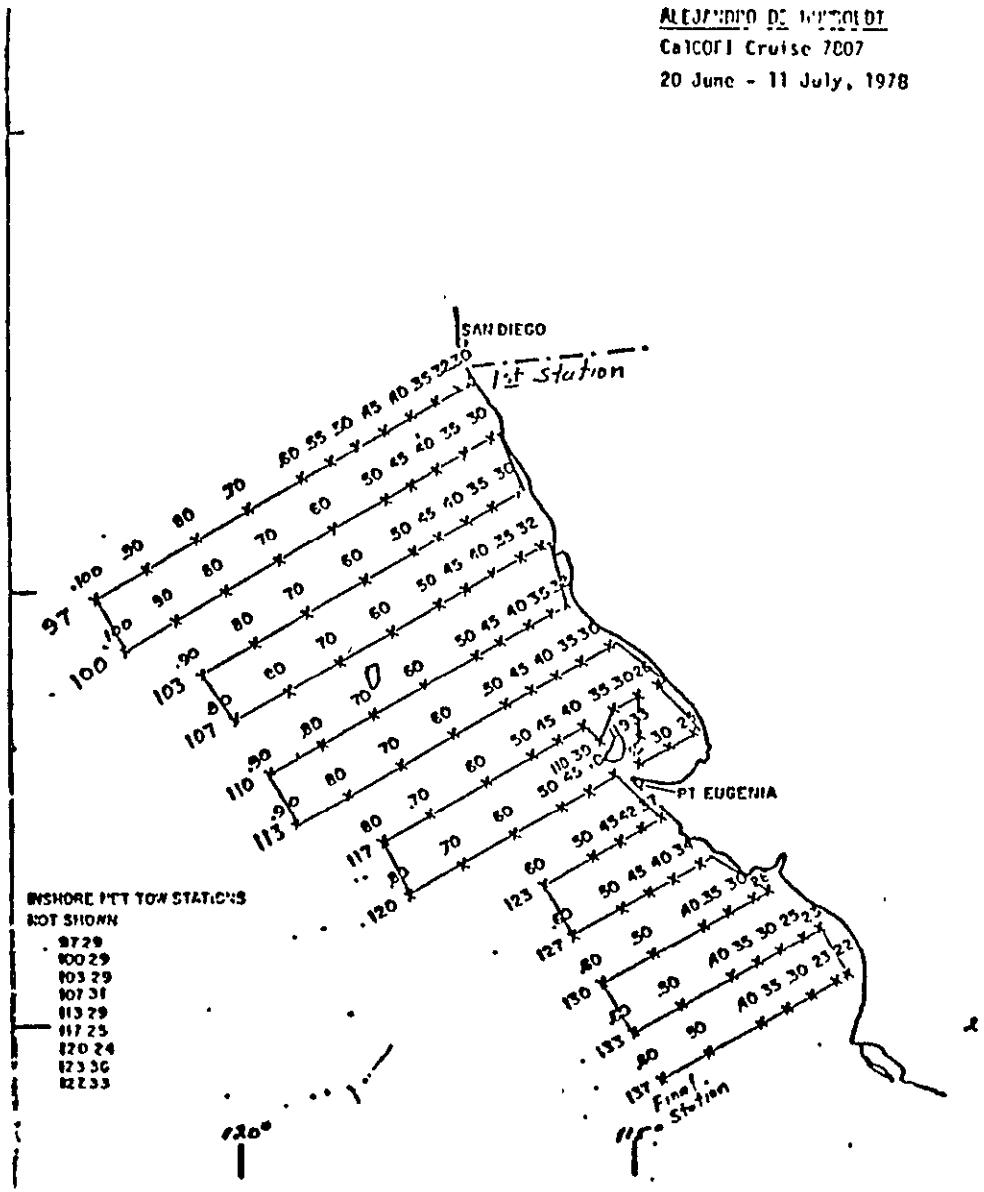

FIGURE 28 MAP - "ALEJANDRO DE HUMBOLDT" CRUISE - 20 JUNE TO 11 JULY 1978

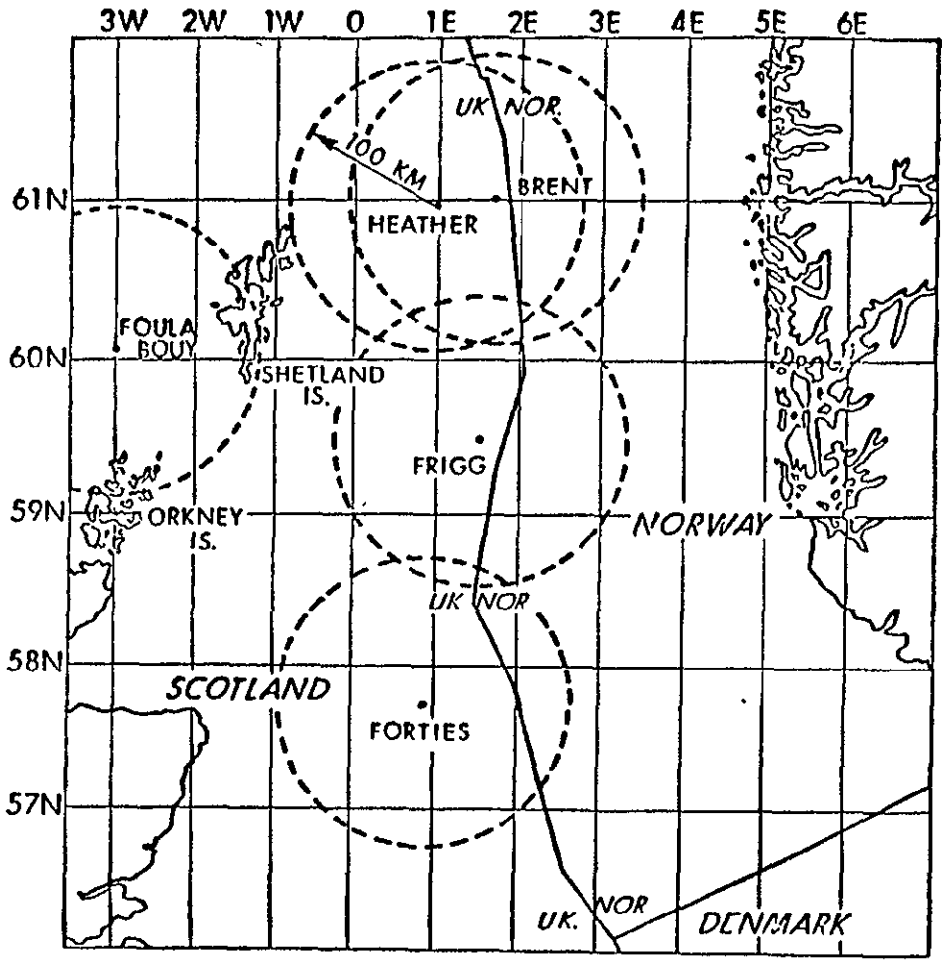

FIGURE 29 NORTH SEA EXPERIMENT AREA

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Mr. Rose of Conoco then described Conoco's recording of wind, waves, sea surface temperatures and currents in the Baltimore Canyon and offshore Sicily in the Mediterranean. Mr. Hayes, representing the U.S. Coast Guard's International Ice Patrol, provided the group with a summary of the IIP Northern Survey experiment conducted by the "USS Evergreen". Table 15 and Figures 30 through 35 outline the cruise of the "USS Evergreen" and the observations taken.

Mr. Echert, representing Oceanographic Systems, Inc., concluded the discussion with a brief talk on the hand-held photographs taken in the North Slope area from ships and helicopters.

TABLE 15 USCGC "EVERGREEN" INTERNATIONAL ICE PATROL CRUISE - 11 AUGUST TO 2 SEPTEMBER 1978

Cruise Track: New London, Ct. to the Grand Banks of Newfoundland to St. John's, Newfoundland to the Grand Banks to New London

DATA:

Hourly Observations of

Sea surface temperature (continuous surface temperature recorder)

Sea surface wind velocity (instantaneous, 9-meter)

Sea state (observer estimated)

Hydrographic casts

36 C/T/D casts 24-29 AUG 1978

Current Meters

9 Intermediate moored current meter arrays
-- 16 Vector averaging current meters (to be retrieved 6/79)

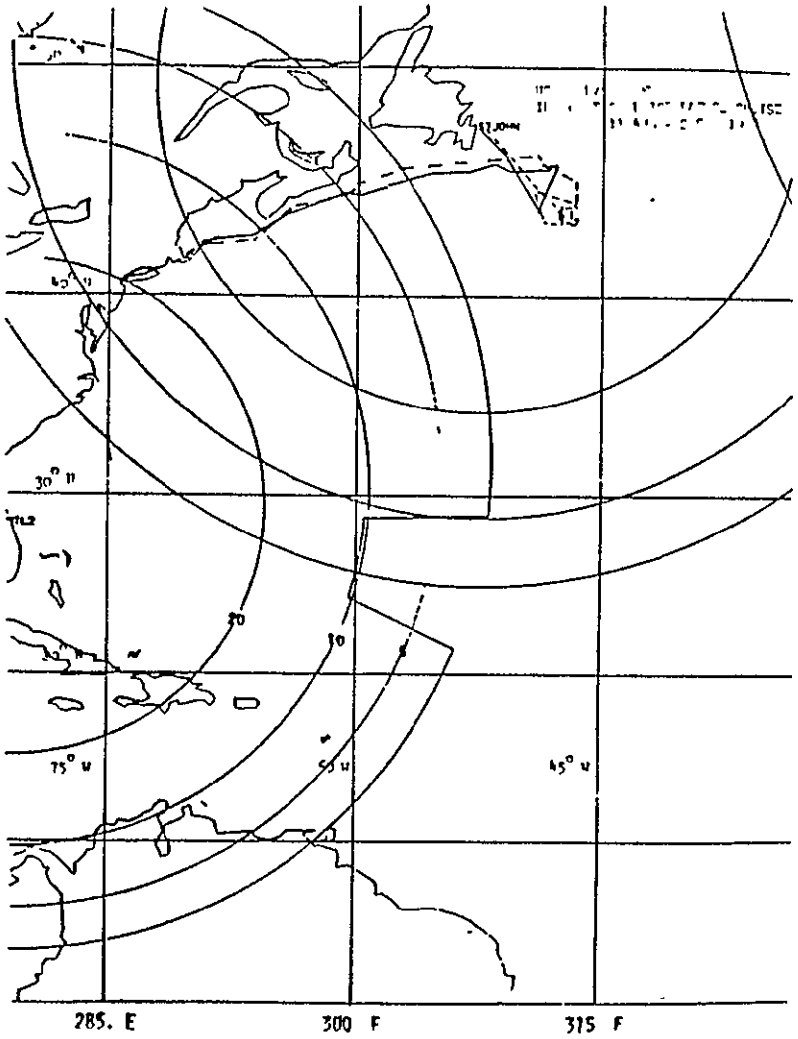

FIGURE 30 MAP - "EVERGREEN" INTERNATIONAL ICE PATROL CRUISE - 11 AUGUST TO 2 SEPTEMBER 1978

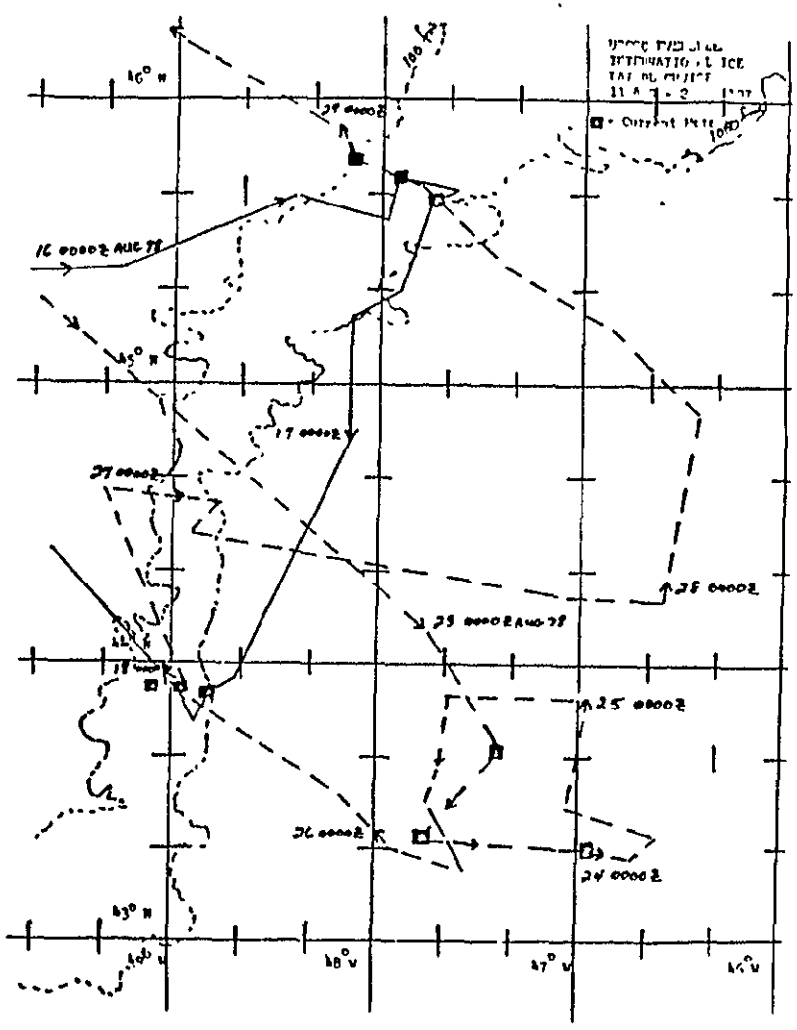

FIGURE 31 MAP - "EVERGREEN" INTERNATIONAL ICE PATROL CRUISE - 11 AUGUST TO 2 SEPTEMBER 1978

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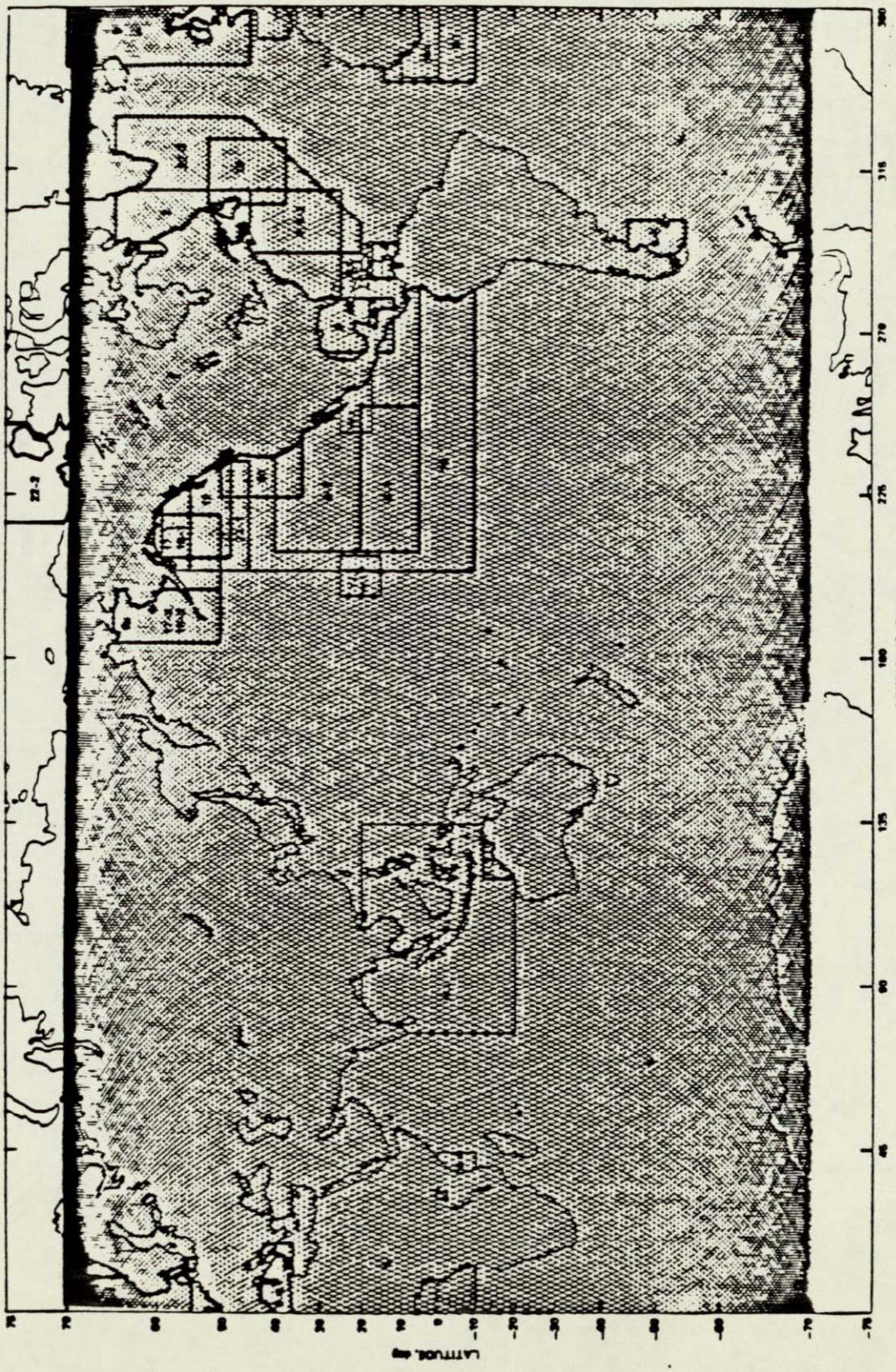

FIGURE 32 MAP OF EXPERIMENT SITES

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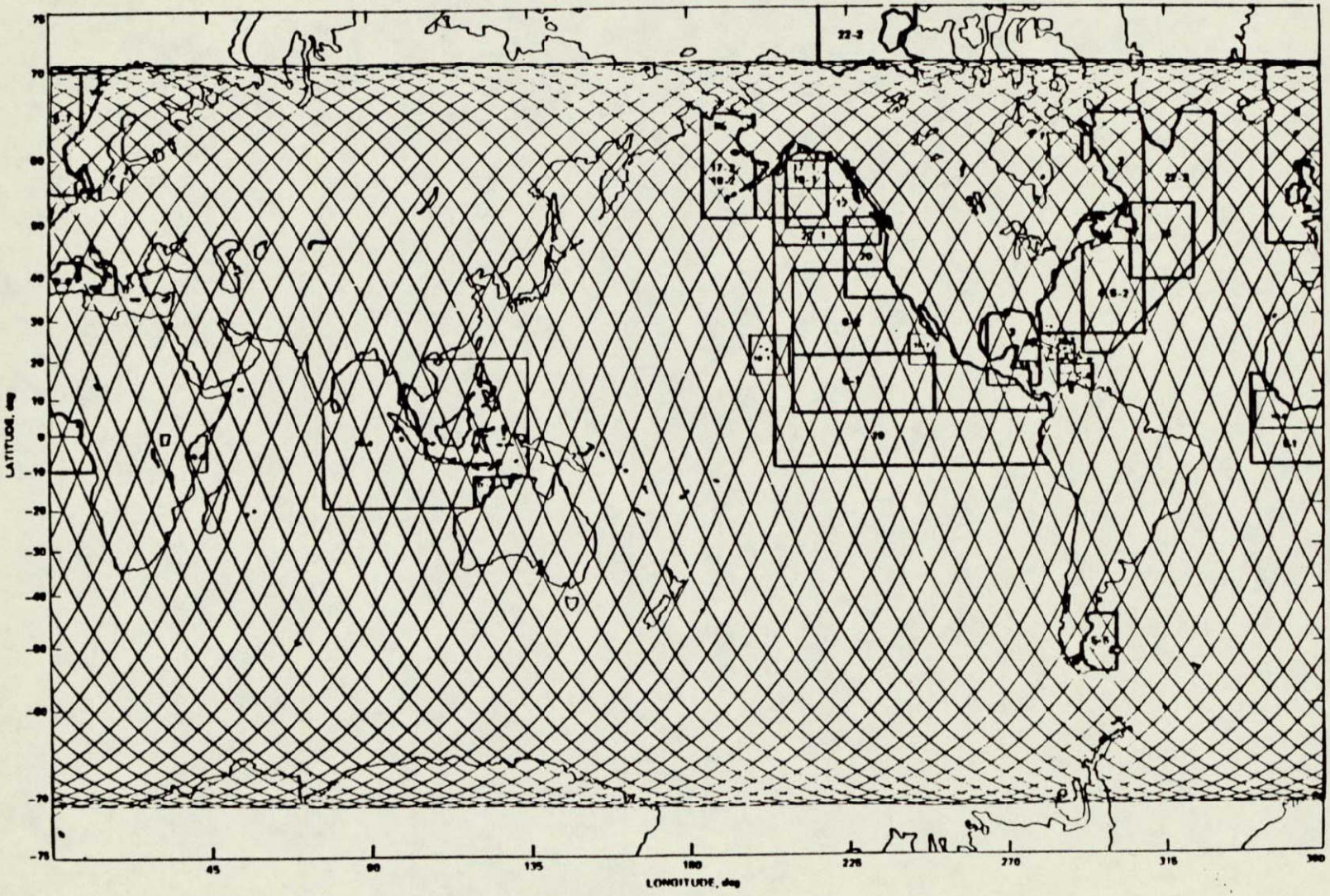

FIGURE 33 MAP OF EXPERIMENT SITES

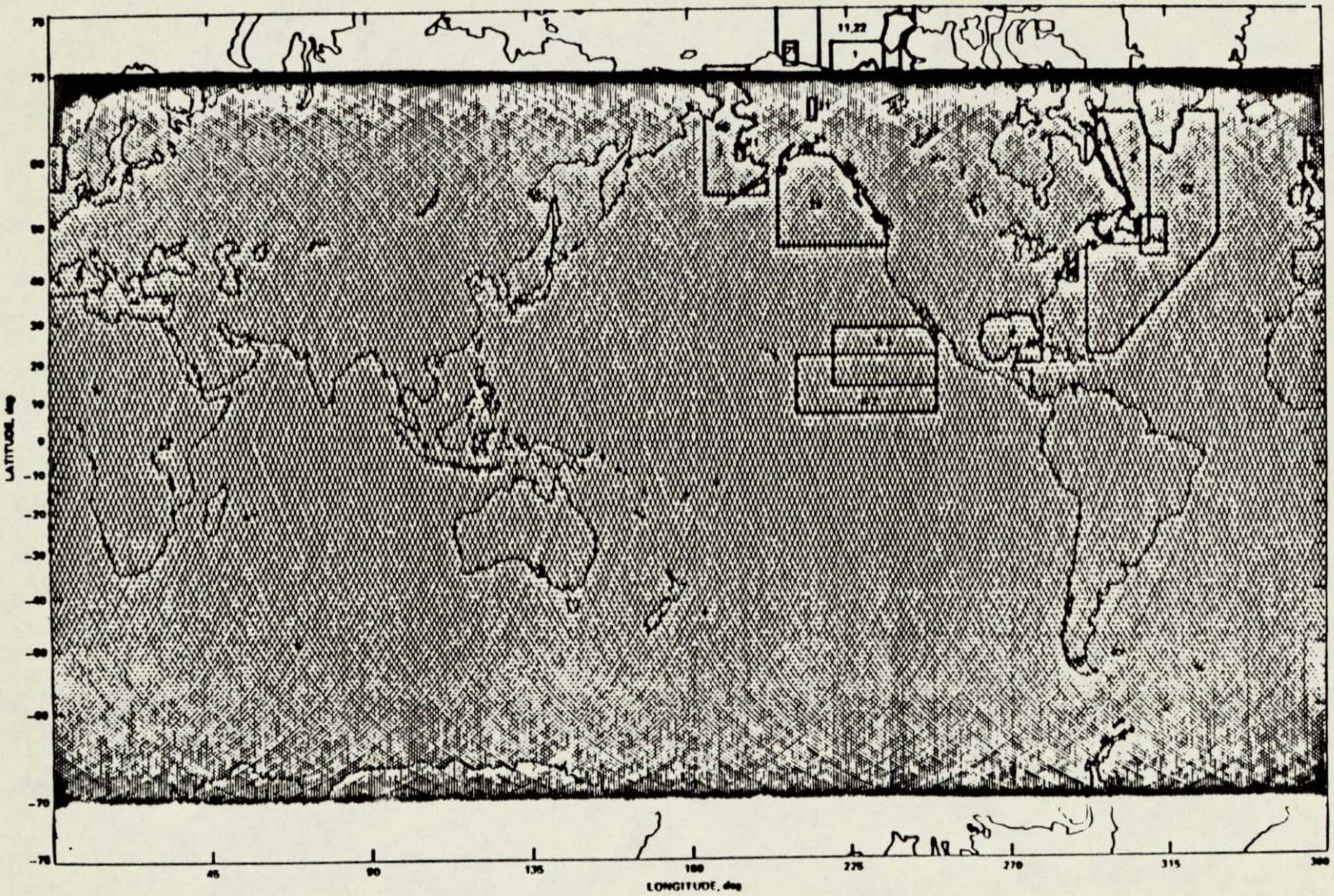

FIGURE 34 MAP OF EXPERIMENT SITES

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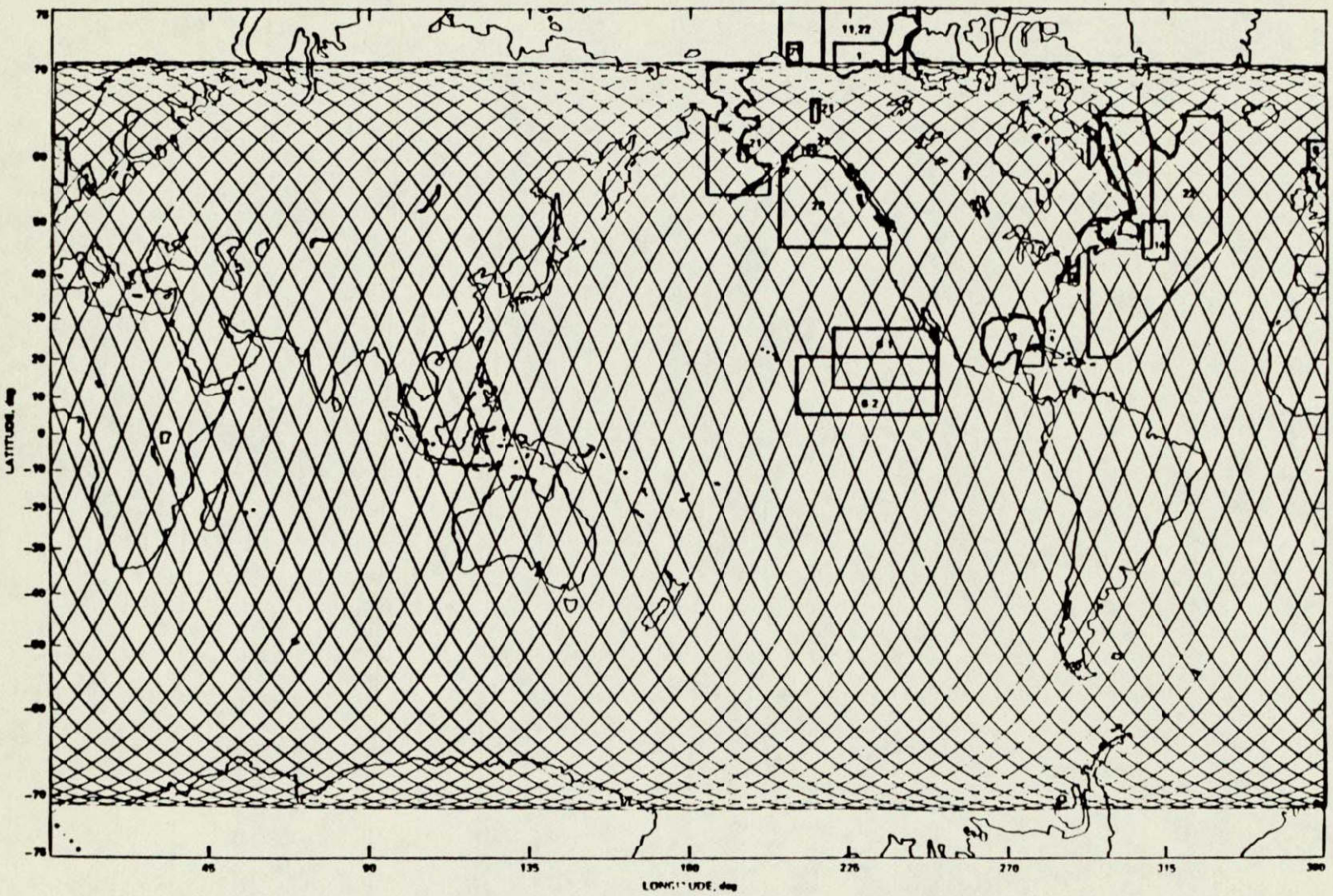

FIGURE 35 MAP OF EXPERIMENT SITES

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8. CONCLUSIONS AND RECOMMENDATIONS

Continuation of the SEASAT-A Commercial Demonstration Program was recommended by all the meeting's participants. A modified set of demonstration objectives can still be achieved utilizing the existing SEASAT-A data set, thus making a modified experiment program possible and desirable. A limitation of the modified program will be that the 99 days of data removes the possibility of assessing the contribution of SEASAT-A data to a real-time decision process, and requires the use of nonreal-time or hindcast analysis techniques. Nonreal-time case studies, to be performed by the industrial experimenters, would replace many of the planned real-time experiments. In these case studies, the industrial experimenters would compare the SEASAT-A data to surface truth and evaluate the impacts that the SEASAT-A data could have produced on operations conducted during the life of SEASAT-A. Additionally, the seasonal contribution of SEASAT to the user community has been eliminated by the limited data set.

The industrial users also urged the continuation of the evaluation of the real-time user data distribution system (UDDS) that has been established at FNWC as a part of the SEASAT-A program. Although the SEASAT-A data content has been removed from the information to be distributed by the failure of SEASAT-A, the users believe that it is still possible to evaluate the worth of a real-time data distribution system. The products available for distribution by this system would include standard FNWC marine analysis and forecast products, possibly supplemented by NIMBUS, GOES and other satellite data. The SEASAT-A UDDS is perceived by many industrial users as a unique capability that does not exist elsewhere and embodying many characteristics that may be desirable in future

SEASAT follow-on systems. The opportunity to evaluate the potential impact of real-time weather and ocean condition data on operations is important to a large segment of the SEASAT industrial user community.

The industrial participants have collected a significant surface truth data base which should be utilized in the SEASAT-A data validation and utility assessment.

This meeting again demonstrated that the industrial maritime and offshore industry is an important resource for NASA and that their data requirements need to be understood in order to develop the basis for future oceanographic satellite systems and programs. Since the economic benefits resulting from improved ocean condition and weather forecasts will come about as a result of industrial and commercial uses of the improved forecasts, it is vital that the industrial community remain a partner with the federal government in the planning and implementation of future programs.

9. GLOSSARY OF TERMS AND ABBREVIATIONS

SASS	Radar Scatterometer
VIRR	Visual Infrared Radiometer
FNWC	Fleet Numerical Weather Central, Monterey, California
UDDS	User Data Distribution System at Fleet Numerical Weather Central
SMMR	Scanning Multifrequency Microwave Radiometer
SAR	Synthetic Aperture Radar
GEOS	Geosynchronous Orbit Satellite, NASA
NIMBUS	NASA's experimental environmental satellite
GSFC	Goddard Space Flight Center, Greenbelt, Maryland
NMFS	National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce
SDR	Sensor Data Record
GDR	Geophysical Data Record
PMDR	Preliminary Master Data File

10. BIBLIOGRAPHY

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The First SEASAT-A Industrial Users Workshop Report, prepared by ECON, Inc. for NASA, February 10, 1978.

SEASAT-A Global Ocean Monitoring System, NASA Headquarters, December 12, 1977.

An Evaluation of SEASAT-A Candidate Ocean Industry Economic Verification Experiments, prepared by ECON, Inc. for NASA, April 1, 1977.

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SEASAT Economic Assessment, Volume VII - Marine Transportation Case Study and Volume VIII - Ocean Fishing, prepared by ECON, Inc. for NASA, October 1975.

SEASAT Economic Assessment, Volume I - Summary and Conclusions, Volume II - The SEASAT System Description and Performance, Volume III - Offshore Oil and Natural Gas Industry, Volume IV - Ocean Mining, Volume V - Coastal Zones, Volume VI - Arctic Operations, Volume IX - Ports and Harbors and Volume X - The Satil 2 Program, prepared by ECON, Inc. for NASA, August 31, 1975.

APPENDIX A

MEETING AGENDA

The following is the agenda for this workshop.

SEASAT
COMMERCIAL DEMONSTRATION PROGRAM
PROGRAM BRIEFING
JET PROPULSION LABORATORY
OCTOBER 31, 1978
9:00 a.m., 180-101

AGENDA

Tuesday, Oct. 31

9:00	Opening Remarks/Briefing Purpose	Giberson/Montgomery
9:30	NASA Headquarters Remarks	Broome
9:45	Sensor Performance Summary	Dunne
10:30	Character of Existing Seasat Data Set	Pounder/Ferrari
11:30	Data Analysis Processing Planning	Dunne
11:45	Data Information/Distribution System Capability Status	Poulson/Ferrari
12:15	Lunch	
1:30	FNWC Plans, Activities, Schedule	Honhart
2:00	User Remarks	
2:30	Discussion Group Sessions	

Wednesday, Nov. 1

8:30	Discussion Group Reports	
10:30	Concluding Remarks	Montgomery

APPENDIX B

ATTENDEE LIST

The following is a list of attendees at this workshop.

NAME	ORGANIZATION	TELEPHONE NO.
LARRAIN LUCKL	ECON	(609) 924-8778
BERNIE MILLER	ECON	" "
CHUCK RAQUET	NASA/LeRC	(216) 433-4000 X291 FTS 294-6291
MICHAEL CRAWFORD	LOCKHEED OCEAN LAB	(714) 298-8245
STEVEN PETEHERYCH	ATMOS.ENV. SERV./CAN	(416) 667-4815
D. C. (SKIP) ECHERT	OCEANOGRAPHIC SYS INC.	(805) 965-6575
ALFRED C. ROBINSON	BATTELLE COLUMBUS LABS	(614) 424-5105
A. GEORGE MOURAD	" " "	(614) 424-5097
CDR. DAVID HONHART USN	FLEET NUMERICAL	(408) 646-2298
JIM CORNELIUS	" "	(408) 646-2817
B. E. BRADFORD	" "	(408) 646-2201
BILL SIAPNO	DEEPSEA VENTURES	(804) 642 2121
MIKE UTT	UNION OIL CO.	(714) 528-7201
JOHN W. SHERMAN, III	NOAA/NESS	(301) 763-8087 FTS 763-8087
S. W. SELFRIDGE	OCEANROUTES	(415) 493-3600
JAMES M. NEWTON	GETTY OIL CO.	(213) 381-7151
ATLE STEEN	KENNECOTT EXPLORATION	(714) 453-3751
J. BRYAN MERCER	DOME PETROLEUM	(403) 232 5978
DIDIER BIERINGER	TOTAL EASTCAN EXPLORATION	(403) 264-9770
BRIAN WRIGHT	GULF CANADA LTD.	(403) 268-4484
L. G. SPEDDING	ESSO RESOURCES CANADA LTD.	(403) 259-0671
BOB JACOBSON	OREGON STATE UNIVERSITY	(503) 265-8380
PAUL HEIKKILA	" " "	(503) 396-3121 X240
R. MICHAEL LAURS	NMFS LaJOLLA	(714) 453-2820 FTS 893-6820
DICK EVANS	" "	(714) 453-2820 FTS 893-6820
FRED JURICK	HUMBOLDT STATE UNIVERSITY	(707) 443-8369
RICHARD M. HAYES	US COAST GUARD	(202) 426-4636 FTS 426-4636
DOUG BROOME	NASA HQ	(202) 755-8618 FTS 755-8618
PAUL M. WOLFF	ODSI	(208) 649-1133
FRANK W. ROSE	CONOCO	(713) 965-2614
TED POUNDER	JPL	(213) 354-5490 FTS 792-5490
DON MONTGOMERY	JPL	(213) 354-2339 FTS 792-2339
AL FERRARI	JPL	(213) 354-7004 FTS 792-7004


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